Central Intelligence Agency

Washington, D.C. 20505

27 September 2017

Mr. Filip Kovacevic
MuckRock News
DEPT MR 23991
411A Highland Avenue
Somerville, MA 02144-2516

Reference: F-2016-01084

Dear Mr. Kovacevic:

This is a final response to your 17 February 2016 Freedom of Information Act (FOIA) request for **all files relating to the development of the nuclear weapons program in Yugoslavia in the period from 1949 to 1990.** We processed your request in accordance with the FOIA, 5 U.S.C. § 552, as amended, and the CIA Information Act, 50 U.S.C. § 3141, as amended.

We completed a thorough search for records responsive to your request and located eight documents, consisting of 84 pages, which we can release in segregable form with deletions made on the basis of FOIA exemptions (b)(1) and/or (b)(3). Copies of the documents and an explanation of exemptions are enclosed.

Additional material was determined to be currently and properly classified and must be denied in its entirety on the basis of FOIA exemptions (b)(1) and (b)(3). Exemption (b)(3) pertains to information exempt from disclosure by statute. The relevant statutes are Section 6 of the Central Intelligence Agency Act of 1949, as amended, and Section 102A(i)(l) of the National Security Act of 1947, as amended. You have the right to appeal this response to the Agency Release Panel, in my care, within 90 days from the date of this letter. Please include the basis of your appeal.

If you have any questions regarding our response, you may contact us at:

Central Intelligence Agency
Washington, DC 20505
Information and Privacy Coordinator
703-613-3007 (Fax)

Please be advised that you may seek dispute resolution services from the CIA's FOIA Public Liaison or from the Office of Government Information Services (OGIS) of the National Archives and Records Administration. OGIS offers mediation services to help resolve disputes between FOIA requesters and Federal agencies. You may reach CIA's FOIA Public Liaison at:

703-613-1287 (FOIA Hotline)

The contact information for OGIS is:

Office of Government Information Services
National Archives and Records Administration
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Contacting the CIA's FOIA Public Liaison or OGIS does not affect your right to pursue an administrative appeal.

Sincerely,

Allison Fong
Information and Privacy Coordinator

Enclosures

Explanation of Exemptions

Freedom of Information Act:

(b)(1) exempts from disclosure information currently and properly classified, pursuant to an Executive Order;

(b)(2) exempts from disclosure information which pertains solely to the internal personnel rules and practices of the Agency;

(b)(3) exempts from disclosure information that another federal statute protects, provided that the other federal statute either requires that the matters be withheld, or establishes particular criteria for withholding or refers to particular types of matters to be withheld. The (b)(3) statutes upon which the CIA relies include, but are not limited to, the CIA Act of 1949;

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(b)(6) exempts from disclosure information from personnel and medical files and similar files the disclosure of which would constitute a clearly unwarranted invasion of privacy;

(b)(7) exempts from disclosure information compiled for law enforcement purposes to the extent that the production of the information (A) could reasonably be expected to interfere with enforcement proceedings; (B) would deprive a person of a right to a fair trial or an impartial adjudication; (C) could reasonably be expected to constitute an unwarranted invasion of personal privacy; (D) could reasonably be expected to disclose the identity of a confidential source or, in the case of information compiled by a criminal law enforcement authority in the course of a criminal investigation or by an agency conducting a lawful national security intelligence investigation, information furnished by a confidential source ; (E) would disclose techniques and procedures for law enforcement investigations or prosecutions if such disclosure could reasonably be expected to risk circumvention of the law; or (F) could reasonably be expected to endanger any individual's life or physical safety;

(b)(8) exempts from disclosure information contained in reports or related to examination, operating, or condition reports prepared by, or on behalf of, or for use of an agency responsible for regulating or supervising financial institutions; and

(b)(9) exempts from disclosure geological and geophysical information and data, including maps, concerning wells.

April 2012

~~TOP SECRET~~ [redacted] (b)(3)

National Intelligence Daily Cable for Monday, April 11, 1977. [redacted] (b)(3) The NID Cable is for the purpose of informing senior US officials.

CONTENTS

ISRAEL: Peres Endorsement Page 1

[redacted] (b)(1)

PAKISTAN: Anti-government Violence Page 4

[redacted] (b)(1)

YUGOSLAVIA: Nuclear Energy Cooperation Page 8

[redacted] (b)(1)

USSR: Protein Synthesis Page 10

[redacted] (b)(1)

SPAIN: Communist Party Page 12

CHINA: Grain Imports Page 13

INTERNATIONAL: Genetic Engineering Research Page 15

ZAIRE: Military Aid Page 17

[redacted]

~~TOP SECRET~~ [redacted] (b)(3)

(b)(3)

[redacted]

(b)(1)
(b)(3)

YUGOSLAVIA: Nuclear Energy Cooperation

[redacted] *//Yugoslavia has proposed that the nonaligned countries cooperate in the development of nuclear energy by pooling their material and financial resources.//* (b)(3)

[redacted] Yugoslavia raised the matter during the current meeting of the nonaligned coordinating council in New Delhi, according to a report from an Indian news agency. The Yugoslavs suggested forming a group of experts to draw up a draft "action program" so that the nonaligned can "emancipate" themselves quickly from their reliance on the developed West for nuclear technology. (b)(3)

[redacted] In Yugoslavia's view, such cooperation might involve prospecting for and creating reserves of nuclear materials, training personnel, building nuclear power stations, establishing national industries for the production of nuclear-related equipment, and conducting joint research in nuclear science. (b)(3)

[redacted] Yugoslavia--like a number of other nonaligned states--has long maintained that all developing countries have the right of unhampered access to sophisticated technology. It seems unlikely that a cooperative program would be effective, although there will probably be little opposition to Belgrade's general proposal. Among the nonaligned, only India has a significant nuclear energy program, and the others have very little to contribute. (b)(3)

[redacted]

(b)(1)
(b)(3)

(b)(3)

(b)(1)
(b)(3)

National
Foreign
Assessment
Center

~~Secret~~
~~NOFORN-NOCONTRACT~~
[redacted]

(b)(3)

Nuclear Programs of Eastern Europe

An Intelligence Assessment

IPS FILE COPY
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~~Secret~~
[redacted]

(b)(3)

July 1979

Copy 009

Warning Notice	Intelligence Sources and Methods Involved (WNINTEL)
National Security Information	Unauthorized Disclosure Subject to Criminal Sanctions

Dissemination Control Abbreviations		
	NOFORN (NF)	Not Releasable to Foreign Nationals
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	REL...	This Information Has Been Authorized for Release to...
	FGI	Foreign Government Information

[redacted]

(b)(3)

National Foreign Assessment Center

~~Secret~~

[redacted] (b)(3)

Nuclear Programs of Eastern Europe [redacted]

(b)(3)

An Intelligence Assessment

Information available as of 1 March 1979 has been used in the preparation of this report.

The author of this paper is [redacted] Nuclear Energy Division, Office of Scientific Intelligence. Comments and queries are welcome and should be directed to the author on [redacted]

(b)(3)

(b)(3)

This paper has been coordinated with OWI, OER, OSR, OPA, DDO, OGCR, and OIA. [redacted]

(b)(3)

The supporting references are identified in a list published separately, are available to authorized persons, and may be obtained from the originating office through regular channels [redacted] Requests for the references should include the publication number and date of this report. [redacted]

(b)(3)

(b)(3)

~~Secret~~

SI 79-10050
July 1979

Table 1

Summary of East European Nuclear Program Elements and Policies

	Albania	Bulgaria	Czechoslovakia	East Germany	Hungary	Poland	Romania	Yugoslavia
[redacted] (b)(1)								
Number, purpose, and status of reactors (OP, operational; UC, under construction; P, planned)	1 suspected research reactor	1 research, 5 power (4 OP, 1 UC)	4 research, 19 power (2 OP, 6 UC, 10 P, 1 shut down)	2 research, 13 power (5 OP, 8 UC)	9 research, (6 zero-power), 6 power (4 UC, 2 P)	6 research, 3 power (2 UC, 1 P)	3 research, 5 power (all P)	3 research, 3 power (1 UC, 2 P)
[redacted] (b)(1)								

Nuclear Programs of Eastern Europe [redacted] (b)(3)

Key Judgments

Status of Technology
The elements of nuclear technology in Eastern Europe range from the modest research reactor suspected to be in Albania to the nuclear components manufactured in the other countries. Czechoslovakia has the most highly developed program; by 1980 it will be able to build entire reactors without Soviet assistance and will begin providing technical assistance to other East European countries. (Table 1 summarizes the status of East European nuclear programs.) [redacted] (b)(3)

Power Generation
All the East European countries except Albania have received major nuclear technology from the USSR and have nuclear power plants in operation, under construction, or planned. Yugoslavia and Romania also have acquired significant Western technology and appear interested in using more in their current programs. [redacted] (b)(3)

The East European countries have set several goals under agreements signed in 1978 as members of the Council for Mutual Economic Assistance (CEMA). One goal is rapid construction of nuclear power stations. Another is production of specialized reactor components to support development of the new Soviet-designed reactor (the VVER-1000) for the East European countries and possibly for Soviet export. Each signatory will have specified obligations supporting the VVER-1000 program. [redacted] (b)(3)

East Europeans see nuclear energy as the long-term solution to their energy problems—for example, the blackouts caused by infrequent but serious shortages. Unlike some Western areas, Eastern Europe shows no evidence of reexamining or changing its nuclear goals. By the end of 1979, nuclear power will produce 3 to 4 percent of the electricity in Eastern Europe from an installed capacity of 4,470 megawatts (MW). [redacted] (b)(3)

All spent fuel from East European reactors will be sent to the Soviet Union, except for the Yugoslav Krsco fuel (to be stored at Krsco) and the CANDU fuel from Romanian reactors. [redacted] (b)(3)

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[redacted]

(b)(3)

[redacted]

(b)(1)
(b)(3)

Contents

Page
KEY JUDGMENTS iii
SUMMARY 1
Albanian Nuclear Program 5
Bulgarian Nuclear Program 5
[redacted] 5 (b)(1)
Power 5
[redacted] 6 (b)(1)
6
Czechoslovak Nuclear Program 6
[redacted] 7 (b)(1)
Power 8
[redacted] 10 (b)(1)
11
East German Nuclear Program 11
[redacted] 11 (b)(1)
Power 12
[redacted] 12 (b)(1)
13
Hungarian Nuclear Program 13
[redacted] 14 (b)(1)
Power 14
[redacted] 15 (b)(1)
16
Polish Nuclear Program 16
[redacted] 16 (b)(1)
Power 17
[redacted] 17 (b)(1)
17
Romanian Nuclear Program 18
[redacted] 18 (b)(1)
Power 19
[redacted] 20 (b)(1)
20
21

(b)(3)

Yugoslav Nuclear Program 21
[redacted] 21 (b)(1)
Power 22
[redacted] 23 (b)(1)
24

Figures

Figure 1. The Czechoslovak Nuclear Organization 7
Figure 2. The East German Nuclear Organization 12

Tables

Table 1. Summary of East European Nuclear Program Elements and Policies ii
Table 2. Nuclear Reactors in Bulgaria 6
Table 3. Nuclear Reactors in Czechoslovakia 9
Table 4. [redacted] 10 (b)(1)
Table 5. Nuclear Reactors in East Germany 13
Table 6. [redacted] 14 (b)(1)
Table 7. Nuclear Reactors in Hungary 15
Table 8. Nuclear Reactors in Poland 18
Table 9. Nuclear Reactors in Romania 21
Table 10. Nuclear Reactors in Yugoslvia 24

Nuclear Programs of Eastern Europe [redacted] (b)(3)

Summary

All of the nuclear energy programs of the East European countries were developed with Soviet assistance. This assistance began in 1949 with the creation of the Council for Mutual and Economic Assistance, which was formed to foster economic development among the member countries (Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, and the Soviet Union). Albania subsequently dropped out and has not participated in the work since 1961. Yugoslavia is not a full member of CEMA, but it does belong to the two open organizations, INTERATOMINSTRUMENT and INTERATOMENERGO. In 1955 and 1956 a series of bilateral agreements were signed with the USSR in which the Soviets pledged assistance in nuclear research to Czechoslovakia, Poland, East Germany, Hungary, Romania, and Bulgaria. The principal facilities provided by the Soviets were two light water–moderated research reactors (VVR-S and IRT-1000), the VVER-440 reactor (a 440–megawatt electrical [MWe] pressurized-water reactor [PWR]), and the enriched uranium fuel for these reactors. [redacted]

At its annual meeting in 1978, CEMA indicated that the main goal of its energy programs would be the rapid construction of nuclear power stations and the production of specialized reactor components. There is to be special emphasis on the design and construction of the VVER-1000, a Soviet-designed 1,000-MWe PWR that is to replace the VVER-440 as the standard Soviet reactor for export to the CEMA members about the mid-1980s. [redacted]

In addition to the participation in research on the VVER-1000 reactor, each CEMA member has the responsibility of specializing in the production of certain components and auxiliary equipment for current reactors. Czechoslovakia is responsible for the production of VVER-440 reactors, steam generators, pressurizers, and turbines. Hungary is responsible for the production of water-treatment equipment, pumps, generator armatures, repair and mounting machines, cranes, and Videoton R-10 minicomputers.[1] Bulgaria is responsible for the production of hermetic doors, Poland for the production of steam generators and accumulators, and East Germany for the production of radiation detectors, instruments, and voltage regulators. [redacted] (b)(3)

To coordinate research efforts in the various CEMA countries, three organizations have been formed—INTERATOMINSTRUMENT, INTERATOMENERGO, and the Joint Institute for Nuclear Research (JINR). INTERATOMINSTRUMENT was formed in Warsaw for standardization of measuring equipment and instruments. INTERATOMENERGO was formed in Moscow for coordination of the specialized production of nuclear components; it is the ordering contractor for nuclear power plants to be built in the CEMA countries after 1980. JINR was established in 1955 at Dubna in the USSR to provide advanced training and research facilities for the CEMA countries. [redacted] (b)(3)

(b)(3)

All the East European countries except Albania have an interest in nuclear power and have nuclear power stations either in operation, under construction, or planned. Yugoslavia and Romania appear to be interested in developing their nuclear programs using Western technology. The other East European countries (except Albania) appear dedicated to Soviet technology for their nuclear programs. [redacted] (b)(3)

Albania has the least developed nuclear energy program in Eastern Europe. Albania has not decided to develop nuclear power and will continue to depend on petroleum for a large part of its energy requirements. The Albanian nuclear research program emphasizes the use of radioisotopes in support of oil drilling and exploitation. [redacted] (b)(3) (b)(3)

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[1] These computers have been used for control at reactor sites, mass spectrography, software development, automated plasma measurements, high-energy research, and isotope analysis. [redacted] (b)(3)

The Bulgarian nuclear program is also very small and is heavily dependent on the Soviets. Bulgaria has only a modest nuclear research program, based on a single Soviet-supplied research reactor. Bulgaria's first nuclear power station, on the Danube River near Kozloduy, will contain four VVER-440 reactors and a VVER-1000 when it is completed in the mid-1980s. The first two reactors began operating in 1974 and 1975. [redacted]

Czechoslovakia has the most highly developed nuclear program in Eastern Europe, including a broad-based research program in reactor and fuel-cycle technology, a large nuclear power program, and a well-developed nuclear industry. Czechoslovakia's first nuclear power reactor—the 150-MWe, heavy water-moderated A-1 at Jaslovske Bohunice—began operating in 1973. It is believed that this reactor has been shut down as a consequence of several nuclear incidents at the reactor between 1975 and 1977. At one time Czechoslovakia planned to base its nuclear power program on such heavy water reactors, but because of significant problems with the A-1, Czechoslovakia currently is basing its nuclear program on Soviet-designed PWRS. The Czechoslovaks plan to have 13 VVER-440 reactors and four VVER-1000 reactors operating by 1990, with the first two VVER-400 reactors coming into operation in 1979. If the reactors now under construction and in the planning stage are completed on schedule, Czechoslovakia will have 6,270 MW of nuclear-electric generating capacity by 1990. [redacted]

By 1980, when new and expanded industrial facilities are completed, Czechoslovakia will be able to build PWRS without Soviet help and will start to supplement the USSR in supplying CEMA countries, and possibly Yugoslavia, with nuclear reactors and other components. Furthermore, Czechoslovakia is developing its own fuel cycle capability [redacted]

[redacted]

East Germany has an impressive nuclear program that is only slightly less developed than Czechoslovakia's. Also, East Germany was the first country in Eastern Europe outside the USSR to operate a nuclear power station. When the Lubmin nuclear power station is completed in about 1985, it will be one of the largest in Eastern Europe, consisting of eight reactors with a total electrical capacity between 3,520 and 4,640 MW. [redacted] (b)(3)

Hungary has a small nuclear research program based on six zero-power reactors and two other small research reactors. The former are used to support (b)(3) research on the VVER-440 and VVER-1000 reactors, and the latter are devoted mainly to the production of radioisotopes for use in research, medicine, and industry. Nuclear power will not become a part of the Hungarian energy program until about 1980, when the first VVER-440 unit at the Paks nuclear power station is expected to become operational. The Paks nuclear power station originally was planned for operation in 1975, but because of economic conditions in the country, the government decided to delay it for five years. [redacted] (b)(3)

Poland has a modest nuclear program that, like Albania's, is devoted mostly to the production of radioisotopes. Because of Poland's abundant cheap fossil fuels, it did not decide to build a nuclear power station until 1974, when it ordered a station from the USSR. Construction of this station has not yet begun. This station ultimately will comprise two VVER-440s and a VVER-1000 reactor. It is doubtful that any of these reactors will be operational before the mid-1980s. Although there is no evidence of a nuclear (b)(3) weapons program, there is evidence of research and development in high explosives. The explosives are used in Polish fusion experiments to generate neutrons. [redacted] (b)(3)

Romania was the first East European country that appeared to be interested in utilizing Western technology for its nuclear energy program. However, because (b)(1) of Soviet pressure, the Romanians reached an agreement in 1970 for the construction of two Soviet VVER- (b)(1) 440 reactors near Pitesti to be operational by the early (b)(3) 1980s. Romanian plans subsequently called for the construction of only one Soviet reactor. The Romanians were insisting that the Soviet reactor [redacted] (b)(1)

[redacted] (b)(1)

[redacted]

[redacted]

(b)(1)
(b)(3)

More recently, Romania and Canada have come to an agreement. Several years of negotiations were rewarded in March 1978 when the two countries agreed to include both fixed and escalated clauses in a contract for four CANDU reactors. In December 1978, Canadian and Romanian banks agreed on a $1 billion loan to finance the reactors. The Romanians are hoping construction of the first CANDU can start by 1980, with an expected operational date about 1986 for that reactor and about 1988 or 1989 for the second [redacted] (b)(3)

Yugoslavia is the second East European country to be interested in acquiring Western technology for its nuclear power program. Yugoslavia has purchased a 632-MWe Westinghouse pressurized water reactor. This nuclear power station is near Krsko and is expected to become operational in mid-1980. [redacted] (b)(3)

The Yugoslavs have encountered several construction problems at the Krsko nuclear power station and consider the pace of construction to be too slow. As a result, they have indicated that they will give greater consideration to French, Japanese, and West German bids for Yugoslavia's second nuclear power station. The Yugoslavs have attempted to pressure Westinghouse to speed up construction at Krsko by mentioning that they were close to negotiating a deal to purchase nine CANDU reactors. Although this may have been a move only to pressure Westinghouse, Yugoslavia's uranium deposits would make CANDU reactors a logical choice to achieve nuclear independence. [redacted] (b)(3)

Nuclear Programs of Eastern Europe [redacted] (b)(3)

Albanian Nuclear Program

Albania's nuclear energy program is the least developed in Eastern Europe and deals solely with basic nuclear research. The Albanian Academy of Sciences is responsible for nuclear research in Albania. [redacted] (b)(3)

In 1970 the Nuclear Radiation Laboratory at Tirana State University was established with the assistance of the People's Republic of China and inaugurated on 1 October 1970. [redacted]

[redacted] (b)(1) (b)(3)

About May 1971 the Nuclear Radiation Laboratory became the Institute of Nuclear Physics (INP). [redacted] (b)(1) The INP is concerned mostly with the application of nuclear technology in medicine, agriculture, hydrology, and industry. The INP supplies radioactive materials to other institutions and is also responsible for monitoring the level of radioactivity in the air, water, and certain foodstuffs. [redacted] (b)(3)

No nuclear power plants are now contemplated, and Albania will continue to depend on petroleum as its major source of energy. Consequently, a large part of the Albanian nuclear research program supports the petroleum industry in such areas as radioactive tracers and activation analysis in the oil-drilling and exploitation industry. [redacted] (b)(3)

Albania has not signed the Non-Proliferation Treaty. Albania has no capability to develop nuclear weapons, however, and has not shown a desire to do so. [redacted]

Bulgarian Nuclear Program

[redacted]

Power

The first Bulgarian nuclear power station is on the Danube River near Kozloduy. This station will consist of four VVER-440 reactors and a VVER-1000, for a total installed capacity of 2,760 megawatts electrical, when the station is completed in the mid-1980s. The first two reactors became operational in 1975 and 1976, respectively. The third and fourth reactors are expected to become operational during 1979 and the fifth about 1987-90. [redacted] (b)(3)

(b)(3)

Table 2

Nuclear Reactors in Bulgaria

	Location	Type	Power Level	Type of Fuel	Date Criticality Achieved or Scheduled
Research reactors					
IRT-1000	Nuclear Research and Power Institute		2 MWt	10%-enriched UO_2	1961
Power reactors					
Kozloduy-1	Kozloduy	PWR	440 MWe	3.3%-enriched UO_2	1975
Kozloduy-2	Kozloduy	PWR	440 MWe	3.3%-enriched UO_2	1976
Kozloduy-3	Kozloduy	PWR	440 MWe	3.3%-enriched UO_2	1979
Kozloduy-4	Kozloduy	PWR	440 MWe	3.3%-enriched UO_2	1979
Kozloduy-5	Kozloduy	PWR	1000 MWe	4.4%-enriched UO_2	1987-90

[redacted]

(b)(3)

While this program is small compared with programs of other countries, it is very important to the economy of Bulgaria. The Kozloduy power station is now producing about 20 percent of the total electric power produced in Bulgaria. By 1990, nuclear power is expected to account for half of the country's power output. The fuel for those reactors is being supplied by the USSR. [redacted]

(b)(3)

The Bulgarians have indicated that reactors in the future will be built on the Danube River near Ruse and on the Black Sea near Varna. These are the only rivers in Bulgaria with an adequate cooling capacity for the large reactors being built. A summary of research and power reactors in Bulgaria is presented in table 2. [redacted]

(b)(3)

At one time the Bulgarians were interested in buying US reactors, but it now appears that they will continue to build reactors based on Soviet technology [redacted]

[redacted]

[redacted]

Czechoslovak Nuclear Program

(b)(1)
(b)(3)
(b)(1)

The Czechoslovak nuclear program was initiated in April 1955 following a bilateral agreement with the Soviets for cooperation in the peaceful uses of nuclear energy. Under this agreement the Soviets provided technical training, personnel, and scientific equipment—consisting mainly of a small research reactor and a cyclotron. Since that time, the Czechoslovaks have established an impressive nuclear energy program. [redacted]

(b)(3)

[redacted]

The direction of the nuclear program is determined by three Czechoslovak ministries and the Atomic Energy Commission [redacted] The Ministry for Fuels and Power is responsible for managing industrial application of nuclear power, developing energy supply programs, and carrying out construction of nuclear power plants. [redacted] The Ministry of Metallurgy and Heavy Engineering directs and supervises production of components and auxiliary equipment for the construction of nuclear plant facilities. [redacted] The Ministry for Technological and Investment Development sets guidelines for investment policy in the scientific sector and directs research and development. [redacted] The Czechoslovak Atomic Energy Commission was established in July 1955 to direct and coordinate nuclear energy developments. Through its "Council for Nuclear Security," the Commission establishes and supervises the location, layout, and operation of nuclear facilities. The actual nuclear program is carried out by a number of scientific, governmental, and industrial organizations. [redacted]

[redacted]

(b)(1)
(b)(1)
(b)(1)
(b)(1)
(b)(3)

[redacted]

Power

The first nuclear power station to begin operation in Czechoslovakia was the A-1 plant at Jaslovske Bohunice. The A-1 is a 150-MWe, natural-uranium-fueled, heavy-water-moderated, gas-cooled reactor that began operation in 1973. Construction of the A-1 plant began in 1958 but suffered 14 years of delays. The delays were due to inadequate Soviet assistance (apparently an attempt to impede independent Czechoslovak reactor development) and two Czechoslovak rejections of Soviet preliminary designs. The Soviets submitted the preliminary designs for the reactor in 1961. The Czechoslovaks rejected the designs because of problems related to fuel rod stability and carbon dioxide coolant pumps. Revised Soviet designs were rejected again, and eventually the Czechoslovaks had to complete the project almost on their own. [redacted] (b)(3)

The A-1 has also had numerous problems since operation began. It has been reported that nuclear-related accidents occurred at the A-1 plant between 1975 and 1977. [redacted] (b)(1) With the problems the Czechoslovaks have had with the A-1 reactor, they are probably in no hurry to get it operational again. [redacted] (b)(3)

Czechoslovakia had assumed that their A-1 program would be a success and had planned an extensive nuclear power program based on the A-1 type reactor. In 1966 the Czechoslovaks announced plans for 2,000 MWe of nuclear capacity by 1980, to include a 300-MWe A-2 and a 500-MWe A-3, both based upon the A-1 design. The A-2 was designed by the Skoda Works, but plans for construction of the A-2 were canceled some time between 1967 and 1970; the A-3 was never designed. The problems that had arisen finally caused the Czechoslovaks to abandon the A-1 type reactor technology and instead to utilize Soviet PWRs for their nuclear program. [redacted] (b)(3)

Table 3

Nuclear Reactors in Czechoslovakia

	Location	Type	Power Level	Type of Fuel	Date Criticality Achieved or Scheduled
Research reactors					
VVR-S	Institute of Nuclear Research (INR)		5 MWt	10%-enriched uranium	1957
TR-0	INR		0	Natural uranium, D_2O moderated	1972
SR-0A	Plzen		0		1970
SR-1	Skoda Works		0	10%-enriched uranium	
Power reactors					
A-1	Jaslovske Bohunice	HWR	150 MWe	Natural uranium, gas cooled	1973
V-1 (Unit 1)	Jaslovske Bohunice	PWR	440 MWe	3.3%-enriched UO_2	1978
V-2 (Unit 2)	Jaslovske Bohunice	PWR	440 MWe	3.3%-enriched UO_2	1979
V-2 (Unit 3)	Jaslovske Bohunice	PWR	440 MWe	3.3%-enriched UO_2	1982
V-2 (Unit 4)	Jaslovske Bohunice	PWR	440 MWe	3.3%-enriched UO_2	1983
V-3 (Unit 1)	Dukovany	PWR	440 MWe	3.3%-enriched UO_2	1982
V-3 (Unit 2)	Dukovany	PWR	440 MWe	3.3%-enriched UO_2	1983
V-4 (Unit 3)	Dukovany	PWR	440 MWe	3.3%-enriched UO_2	1983
V-4 (Unit 4)	Dukovany	PWR	440 MWe	3.3%-enriched UO_2	1984
JEOT I (Unit 1)	Prague North	PWR	440 MWe	3.3%-enriched UO_2	1984
JEOT I (Unit 2)	Prague North	PWR	440 MWe	3.3%-enriched UO_2	1985
JEOT II	Brno	PWR	440 MWe	3.3%-enriched UO_2	1985
JEOT III (Unit 1)	Bratislava	PWR	440 MWe	3.3%-enriched UO_2	1986
JEOT III (Unit 2)	Bratislava	PWR	440 MWe	3.3%-enriched UO_2	1987
V-5 (Unit 1)	Slovakia	PWR	1,000 MWe	4.4% UO_2	1986
V-5 (Unit 2)	Slovakia	PWR	1,000 MWe	4.4% UO_2	1987
V-6 (Unit 1)	Bohemia	PWR	1,000 MWe	4.4% UO_2	1988
V-6 (Unit 2)	Bohemia	PWR	1,000 MWe	4.4% UO_2	1989
V-7	Unknown	LMFBR [1]	1,000 MWe		After 1990

[1] Liquid metal fast breeder reactor.

[redacted] (b)(3)

In April 1970, an agreement was concluded between Czechoslovakia and the USSR for Soviet assistance in the construction of two nuclear power stations—the V-1 adjacent to the A-1 at Jaslovske Bohunice, and the V-2 at Dukovany. The first reactor at the V-1 site probably underwent startup testing in late 1978, the second reactor will probably become operational in late 1979. [13, 14] The fuel for the entire life of the reactors will be provided by the USSR, and the spent fuel elements will be returned to the USSR. [redacted] (b)(3)

Current Czechoslovak nuclear power plans call for the construction of 10 nuclear reactors between 1980 and 1990, with a cumulative installed electric power capacity of 5,000 to 7,500 MWe by 1985 and 12,000 MWe by 1990. Those ranges depend upon the introduction of a larger pressurized-water reactor after 1980 having an installed electric power capacity of 1,000 MWe. These nuclear power reactors and others that are planned are summarized in table 3. [redacted] (b)(3)

The April 1970 agreement also provided for Czechoslovakia to cooperate in the Soviet fast breeder reactor (FBR) development program, although the Czechoslovaks do not envisage an FBR for themselves until after 1990. They have contributed to the Soviet FBR program, however, by providing a steam generator for the Soviet BN-350 LMFBR at Shevchenko. This steam generator has been tested in the Soviet BOR-60 test reactor [redacted]

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[redacted]

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[redacted]

East German Nuclear Program

The East German nuclear program was initiated in 1955 with the conclusion of a bilateral agreement with the USSR for cooperation in the peaceful uses of atomic energy. The GDR's nuclear energy program is carried out by three ministries (see figure 2). The Ministry for Science and Technology establishes scientific policy and directs applied research and development. [19] The Ministry for Coal and Energy plans the industrial application of nuclear technology, develops programs to build nuclear power plants, and carries out nuclear power plant construction through the VEB (state-owned) power plant construction combine, which is subordinate to it. The Ministry for Construction of Heavy Machinery and Equipment plans and supervises the production of components and auxiliary equipment. [19] The State Office for Atomic Safety and Radiation Protection also exerts great influence on the nuclear program through its function as radiation protection and approval authority [redacted] (b)(3)

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[redacted] (b)(1)
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The Central Institute for Isotope and Radiation Research was established in 1969 at Leipzig. This institute conducts basic research in the areas of radioactive decay, the use of isotopes in biology and medicine, and the application of tracer elements. [redacted] (b)(3)

[redacted]

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(b)(3)

Power

East Germany was the first CEMA country outside the USSR to operate a nuclear power station. This station, located at Rheinsberg, began operating in 1966 with a Soviet-supplied, 70-MWe pressurized water reactor. In 1974 and 1975 two Soviet VVER-440 PWRs at Lubmin, out of a total of eight reactors planned, were started up [redacted] The third VVER-440 reactor began operation some time between late 1977 and mid-1978. [22] The fourth is externally complete and is expected to begin operation during 1979. The remaining four reactors will probably become operational at yearly intervals after 1982. [redacted]

The first six reactors at Lubmin will be VVER-440s, and the final two will possibly be VVER-1000s. When this station is completed, in about 1985, it will have an installed electric power capacity of between 3,520 and 4,640 MWe. The third East German nuclear power station is under construction at Niedlergorne near Magdelburg. Reportedly this station will utilize four VVER-440 reactors. However, it is now in such an early stage of construction that neither the type nor the number of reactors can be confirmed [redacted]

(b)(3)

East German plans for construction and operation of future nuclear reactors call for 5,500 MW of installed power by 1985. It appears that installed nuclear capacity will be about 1,830 MW by 1980, or about 8 percent of total generating capacity. The East Germans should have no trouble in meeting their 1985 goal. A summary of East German research and power reactors is presented in table 5. [redacted]

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[redacted]

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Table 5

Nuclear Reactors in East Germany

	Location	Type	Power Level	Type of Fuel	Date Criticality Achieved or Scheduled
Research reactors					
VVR-S	Central Institute for Nuclear Research		5 MWt	10%-enriched uranium	1957
SEG	Central Institute for Nuclear Research	Argonaut	10 kWt	20%-enriched uranium	1962
Power reactors					
Rheinsberg	Rheinsberg	PWR	70 MWe	3.3%-enriched UO_2	1966
Lubmin-1	Lubmin	PWR	440 MWe	3.3%-enriched UO_2	1974
Lubmin-2	Lubmin	PWR	440 MWe	3.3%-enriched UO_2	1975
Lubmin-3	Lubmin	PWR	440 MWe	3.3%-enriched UO_2	1978
Lubmin-4	Lubmin	PWR	440 MWe	3.3%-enriched UO_2	1979
Lubmin-5	Lubmin	PWR	440 MWe	3.3%-enriched UO_2	1982
Lubmin-6	Lubmin	PWR	440 MWe	3.3%-enriched UO_2	1983
Lubmin-7	Lubmin	PWR	440 MWe	3.3%-enriched UO_2	1984
Lubmin-8	Lubmin	PWR	440 MWe	3.3%-enriched UO_2	1985
Niedlergorne-1	Magdeburg	PWR	440 MWe	3.3%-enriched UO_2	1984
Niedlergorne-2	Magdeburg	PWR	440 MWe	3.3%-enriched UO_2	1985
Niedlergorne-3	Magdeburg	PWR	440 MWe	3.3%-enriched UO_2	1986
Niedlergorne-4	Magdeburg	PWR	440 MWe	3.3%-enriched UO_2	1987

[redacted]

(b)(3)

produced by radiochemical laboratories and reactors are being stored in an old salt mine near Bartensleden. [23] [redacted]

[redacted]

[redacted]

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Hungarian Nuclear Program

The Hungarian nuclear program started in 1955 following the conclusion of a bilateral agreement with the USSR for cooperation in the peaceful uses of atomic energy. Since that time, the Hungarian program has concentrated on isotope production for agricultural, medical, and industrial applications. Hungary has a small nuclear research program, directed by the Hungarian Atomic Energy Commis-

[redacted]

sion, with research activities performed, for the most part, under the auspices of the Hungarian Academy of Sciences. Current Hungarian emphasis is on the use of radioactive isotopes for research, medicine, and industry and for research in cooperation with other CEMA members on the VVER-1000 reactor. Hungary will not have a nuclear power plant operational before 1980. [redacted]

[redacted]

[redacted]

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Power

The first Hungarian nuclear power station is under construction near Paks on the Danube River. Construction was started in 1969, and the station originally was planned to be in operation by 1975. The Hungarians decided, however, that economic conditions in their country did not warrant introducing nuclear power before 1980, and the station was temporarily delayed. This site will contain four VVER-440 reactors

Table 7

Nuclear Reactors in Hungary

	Location	Type	Power Level	Type of Fuel	Date Criticality Achieved or Scheduled
Research Reactors					
ZR-1-ZR-6	Central Physics Research Institute		Less than 100 kWt	Slightly enriched UO_2	1959-72
Budapest	Budapest Technical University		10 kWt		1971
VVR-S	Central Physics Research Institute		3.3 MWt	33%-enriched UO_2	1959
Debrecen	Debrecen Research Institute		1 MWt		
Power Reactors					
Paks-1	Paks	PWR	440 MWe	3.3%-enriched UO_2	1980
Paks-2	Paks	PWR	440 MWe	3.3%-enriched UO_2	1981
Paks-3	Paks	PWR	440 MWe	3.3%-enriched UO_2	1982
Paks-4	Paks	PWR	440 MWe	3.3%-enriched UO_2	1983
Paks-5	Paks	PWR	1,000 MWe	4.4%-enriched UO_2	1987-90
Paks-6	Paks	PWR	1,000 MWe	4.4%-enriched UO_2	1987-90

[redacted] (b)(3)

and two VVER-1000 reactors for a total capacity of 3,760 MWe. The VVER-440 reactors will come on line at the rate of one per year between 1980 and 1983, and the two VVER-1000 reactors will be constructed after 1985. When the Paks station is complete, in about 1990, it will supply 25 to 30 percent of the country's electric power requirements. [75] A summary of Hungarian research and power reactors is presented in table 7. [redacted] (b)(3)

[redacted] (b)(1) (b)(3)

[redacted] (b)(1)

[redacted]

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(b)(3)

Polish Nuclear Program

The Polish nuclear energy program began on 23 April 1955 with the conclusion of a bilateral agreement with the USSR for Soviet assistance in the construction of a research reactor and a cyclotron and in the training of personnel. In June 1955 the Polish Government established the Institute of Nuclear Research under the auspices of the Polish Academy of Sciences (PAN). The Polish nuclear program is devoted mostly to the application of radioactive isotopes for scientific, industrial, and medical uses. [redacted]

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[redacted]

[redacted]

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Power

Thus far, because of Poland's heavy reliance on the country's abundant coal resources, there has not been much of a program to develop nuclear power. Because of the rising cost of developing coal sources, however, nuclear energy will play a very important part in the future. Poland's plans are for nuclear to account for 13 percent of installed power by 1990. A VVER-440 reactor is expected to be operational by 1984 on Lake Zarnowiec near Gdansk. Poland now plans to construct another VVER-440 reactor at the site, with operation expected about 1985, and a VVER-1000 is to begin operation about 1987. Fast breeder reactors are expected to be introduced into the program after 1990. A summary of Poland's research and power reactors is presented in table 8. [redacted]

(b)(3)

The Polish nuclear power program is controlled by the Soviet Union. The program will utilize Soviet reactors and other Soviet specialized equipment. It is doubtful that Poland could make any significant steps in the nuclear field without Soviet assistance. [redacted]

(b)(3)

Table 8

Nuclear Reactors in Poland

	Location	Type	Power Level	Type of Fuel	Date Criticality Achieved or Scheduled
Research reactors					
EWA	Institute of Nuclear Research (IBJ)		10 MWt	10%-enriched uranium	1958
Helena	IBJ		0		
Anna	IBJ		100 Wt		
Maryla	IBJ		10 kWt		
Maria	IBJ		60 MWt [1]	80%-enriched uranium	1974
UR-100	Institute of Physics and Nuclear Technology		100 kWt		1980
Power reactors					
ZARNOWIEC-1	Gdansk	PWR	440 MWe	3.3%-enriched UO_2	1984
ZARNOWIEC-2	Gdansk	PWR	440 MWe	3.3%-enriched UO_2	1985
ZARNOWIEC-3	Gdansk	PWR	1,000 MWe	4.4%-enriched UO_2	1987

[1] Presently at 40 MWe but being upgraded to 60 MWt.

[redacted]

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Romanian Nuclear Program

The Romanian nuclear program was initiated in 1955 following the conclusion of the Romanian-Soviet bilateral agreement for cooperation in the peaceful uses of nuclear energy. The State Commission on Nuclear Energy (CSNE) coordinates and directs all aspects of nuclear research, but the actual nuclear program is carried out under the auspices of the Romanian Academy of Science. [redacted]

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[redacted]

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Nuclear research is being carried out in a wide variety of areas at the IFA. One of the more important areas is laser isotope separation (LIS). [redacted]

[redacted] (b)(1) (b)(3) (b)(1)

Power

In the future, Romania is planning to have the capability to build nuclear power reactors. Romania has been considering nuclear power since 1965 and has solicited assistance for a nuclear power program from the United Kingdom, West Germany, France, Sweden, and Canada. Over the years Romania has maintained a strong leaning toward Western rather than Soviet nuclear technology and has continually attempted to acquire Western equipment. Romania has been reluctant to request assistance from the USSR to avoid becoming dependent upon the Soviets for enrichment services. The Romanians also have shown displeasure with Soviet reactors because of the lack of secondary containment and emergency core-cooling systems. [redacted] (b)(3)

In March 1970, however, because of Soviet pressure, it was announced that the USSR and Romania had concluded an agreement for the USSR to build a nuclear power station in Romania. The station was to be located at Pitesti on the Danube River and contain one Soviet VVER-440 reactor, to become operational about 1985. Romania's intention to purchase only one reactor, instead of the customary two or more reacto(b)(1) for a station, is an indication that Romania still is no(b)(3) happy with Soviet safety practice. Since that time, in fact, Romanian officials have indicated that the Soviet agreement was in principle only and that construction of the power station would not start until necessary safety features were incorporated. Soviet reluctance to incorporate the safety features may have led to the reported demise of the deal. [44] Romania held detailed discussions with Westinghouse and with a Finnish firm for the purchase of an ice-condensor containment system for the Soviet reactor. [45] The Romanians seemed very pleased with systems from both vendors and appeared certain to buy from at least one of them. Since the discussions, however, nothing has happened. [redacted] (b)(3)

It now appears that the Romanians have decided on the CANDU for their nuclear program. They have finally concluded an agreement with Canada under which at least four CANDU reactors will be supplied. It had been reported at one time that Romania was interested in as many as 16 CANDUs, but detailed negotiations in March 1978 and an agreement in December 1978 resulted in contracts for only the four reactors with an option to purchase more CANDUs at a later date. [redacted] (b)(3)

The main problem in reaching an agreement had been pricing and warranties. In previous negotiations, Romania had requested a fixed-price contract, but because Canada had lost several million dollars in a similar fixed-price contract with Argentina, Canada wanted an escalated-cost contract. The settlement reached in March was a compromise. The part of the contract pertaining to Romanian input will be conducted on a fixed-price basis, while escalation terms will cover components to be purchased from Canada. [46] A consortium of Canadian banks signed an agreement with the Romanian Bank of Foreign Trade, giving Romania a loan of $1 billion to finance the construction of the reactors. [47] The first reactor will not be operational before 1985. Cernavoda has been decided as the location for the power station. [redacted] (b)(3)

Romania envisages nuclear power supplying 20 percent (6,000 MWe) of installed electric generating capacity by the year 2000. It is very doubtful that the Romanians could reach this long-term goal, even if construction on the CANDU reactors were started in 1979. A summary of Romania's research and power reactors is presented in table 9. [redacted] (b)(3)

[redacted] (b)(1) (b)(3)

[redacted] (b)(1) (b)(3)

Table 9

Nuclear Reactors in Romania

	Location	Type	Power Level	Type of Fuel	Date Criticality Achieved or Scheduled
Research reactors					
Triga	Institute for Nuclear Technology		14 MWt	93%-enriched UO_2	1980
	Institute for Nuclear Technology		0		
VVR-S	Institute of Atomic Physics		3.5 MWt		1957
	Institute of Atomic Physics		0		1962
Power reactors					
Pitesti	Pitesti	PWR	440 MWe	3.3%-enriched UO_2	1985
Cernovada	Cernovada	CANDU	600 MWe	Natural UO_2	1986

[redacted]

nuclear energy agency in research and the development on heavy water reactor technology, but there has been no evidence of such cooperation. [53] [redacted]

[redacted]

[redacted]

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Yugoslav Nuclear Program

The Yugoslav nuclear program began in 1956 following the conclusion of the Soviet-Yugoslav bilateral agreement for cooperation in the peaceful uses of atomic energy on 28 January 1956. The Federal Commission for Nuclear Energy was established to direct and coordinate the Yugoslav program. Under this commission there are five institutes and a center engaged in both fundamental and applied research. [redacted] (b)(3)

[redacted] (b)(1)

[redacted]

[redacted]

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(b)(3)

Power

The first Yugoslav nuclear power station is under construction at Krsko on the Slóveno-Croatian border. A 632-MWe PWR is being built there by US Westinghouse and is scheduled to start operating in middle to late 1980. Originally the reactor was to start operating in 1978, but a variety of problems have pushed it several years behind schedule. [redacted] The Yugoslavs have announced plans for two more nuclear power stations. One, with a capacity of 800 to 1,000 MWe, is planned for the island of Vir. This station will begin operating about the mid-1980s. The other is planned for the Zagreb area, with operation planned for 1990. [redacted]

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The Yugoslavs have encountered several problems trying to complete the Krsko plant and have shown considerable displeasure with US construction. The most difficult problem was obtaining the US reactor export license. This was the only reactor license application to come up under provisions solely for IAEA safeguards. The United States wanted to arrange a bilateral agreement, in addition to the IAEA safeguards, to give the United States more control. The Yugoslavs finally convinced the United States that no US technology or equipment would be transferred without US approval, and the license was issued on 20 May 1977. [redacted]

Other problems have resulted from changes in scope, such as upgrading the seismic design of the facility from 0.2 G [3] to 0.3 G. Also, the Save River was found to be inadequate as a cooling source for the reactor, and a number of cooling towers had to be added. These changes reportedly will cost Yugoslavia about an additional 3 percent of the original contract price [redacted] [redacted] (b)(b)(3) (b)(3) (b)(3)

There have been other problems as well. On 11 September 1977 the carrier transporting the second 317-ton steam generator for the reactor tipped over. Damage to the steam generator was reported to be enormous. About the same time, the reactor vessel for the plant was left stranded near the Victor Lenac Shipyard in Rjeka because of a mechanical failure to the transporter carrying it. [redacted] There has also been a constant shortage of housing for project workers [redacted] (b)(1) (b)(3)

In an effort to install nuclear power plants more expeditiously in energy-poor areas, the Yugoslavs have inquired among several other countries (including France, Japan, and West Germany) about building their second and third nuclear power plants. [69] The Soviets have been mentioned, but it is unlikely that the Yugoslavs will turn to the USSR to build either of these power stations. The Yugoslavs are almost completely independent of Soviet influence over their nuclear power programs and would like to retain that independence. Furthermore, the Yugoslavs are concerned about the Soviet failure to incorporate Western-style safety features into their power reactors. A summary of Yugoslavia's research and power reactors is presented in table 10. [redacted] (b)(3)

Uranium for Yugoslav reactors probably will come from the Zirovski Vrh mine in Slovenia. The mine is projected to produce 300,000 tons of uranium ore per year, enough for about 300 tons of uranium oxide. The enrichment of the fuel will be arranged by Westinghouse. [redacted] (b)(1) Yugoslavia's uranium oxide reserves are estimated at about 3,000 tons. The Yugoslavs also are considering a joint venture with a US company to produce uranium, and they are considering the possibility of joint ventures in uranium exploration in Africa [redacted] (b)(3)

[redacted] (b)(1) (b)(3) (b)(3)

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[3] Acceleration of gravity.

Table 10

Nuclear Reactors in Yugoslavia

	Location	Reactor Type	Power Level	Type of Fuel	Date Criticality Achieved or Scheduled
Research reactors					
RB	Boris Kidric Institute		0	Natural uranium D_2O moderated	1958
RA	Boris Kidric Institute		10 MWt	2%-enriched uranium D_2O moderated	1959
Triga-II	Josef Stefan Institute		250 kWt		1966
Power Reactors					
Krsko	Krsko	PWR	632 MWe		1980
Zadar	Island of Vir		800-1,000 MWe		Planned
Zagreb	Zagreb		1,000 MWe		Planned

[redacted]

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CURRENT INTELLIGENCE WEEKLY SUMMARY

21 February 1957

[redacted] The USSR is reportedly withholding promised economic credits and threatening even greater sanctions, such as suspension of Soviet shipments of iron ore, oil, and grain, which, however, are still arriving. It is also hampering the repatriation of Poles now in the USSR. There are indications, too, of stronger Soviet opposition to Gomulka's efforts to improve relations with the West and to seek credits and assistance from that direction. [redacted]

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SOVIET-YUGOSLAV RELATIONS

Recent Kremlin moves appear calculated to bring the dispute with Tito to a head. The Russian leaders appear willing to read Tito completely out of the Communist world unless he is willing to make sufficient compromises in his position to allow some new form of modus vivendi. The Kremlin presumably has no intention of returning to such Stalin-era types of pressure on Yugoslavia as border incidents, name calling, and complete economic blockade. In its present foreign policy orientation of "coexistence," it will presumably find a way of coexisting with Tito, but not as a comradely Communist.

The Kremlin leaders' increasing fears over Gomulka's course in Poland may be the cause of the stepped-up pace of their anti-Tito moves, even though they probably had concluded by November that Yugoslavia, with its present attitude, could no longer be tolerated even in a "fringe" position in the Communist world. Soviet bloc propaganda has often connected Yugoslav and Polish ideas [redacted]

The strongest official Soviet statement thus far was made by Dmitry Shepilov in his final report as Soviet foreign minister on 12 February when he made future development of all Yugoslav-Soviet relations contingent on a change in the Yugoslav ideological attitude. Belgrade has reacted sharply to this, stating that since Yugoslavia bore no responsibility for the past abnormal relations, further development of relations would depend on the Soviet attitude, and that the Yugoslav position remains unchanged.

[redacted]

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Moscow is also reported to have proposed a meeting of all Communist leaders to take place this spring in Prague to settle ideological differences and establish Communist unity. The Yugoslavs refused an invitation, however, believing they would

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be placed in the position of a defendant before hostile judges.

The Yugoslavs report that their recent economic negotiations with Moscow have taken place in an "icy" climate. They say they have found the USSR recalcitrant on reaching reasonable prices for such items as coking coal, as well as on determining quotas for numerous other goods. They also report that Moscow is now unwilling to start implementing the joint Soviet-East German 700,000,000 ruble ($175,000,000) credit for the development of a large aluminum complex in Yugoslavia until the present Soviet Five-Year Plan is completed in 1961. The Yugoslavs view the Soviet retreat on this project and on the agreement to assist in developing the Yugoslav nuclear energy program as an explicit pressure tactic.

During all these moves, commmunications have passed back and forth between Tito and Khrushchev. The Yugoslavs publicly have shown a strong desire to avoid a deterioration in relations, even though they are not retreating on their basic views. In a New Year's interview, Tito strongly emphasized the need to separate state relations from the ideological discussions, and in the latter, he called for dignified, comradely discussion, not "polemics." From that date until the Borba blast on 14 February, the leading Yugoslav newspapers largely refrained from answering the numerous Soviet bloc attacks on Yugoslavia, "national Communism," "revisionism," and on other sins with which the Yugoslavs have been charged. [redacted]

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MOLLET'S VISIT TO WASHINGTON

French premier Mollet, who arrives in Washington on 26 February, is hoping to use the visit to buttress his domestic political position. Despite has government's success in the UN debate on Algeria, there are signs that the right-center is ready to launch an all-out attack on the government's economic, European integration, and Algerian policies.

Mollet is expected to discuss a wide range of topics with American officials which he probably hopes will give him new ammunition with which to fend off critics at home. France's growing inflation and budgetary problems are confronting Mollet with increasing parliamentary difficulties which may come to a head shortly after his return, and reports are again current that the right-center is planning to use an economic issue to bring down the government before it makes too many concessions in Algeria or on EURATOM and the Common Market.

Although Paris insists requests for financial aid as such are not on the premier's agenda, discussion of France's economic difficulties is implicit in such proposed topics as European defense, the Middle East, and underdeveloped areas.

The prestige of Mollet's government, particularly that of Foreign Minister Pineau, has soared with France's successful defense of its Algerian policy in the UN. At the same time, however, there is a growing awareness in both the government and its opposition that Mollet now is morally committed to the formula of a cease-fire, elections and negotiations contained in his declaration of

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SCIENTIFIC INTELLIGENCE REPORT

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THE YUGOSLAV ATOMIC ENERGY PROGRAM

8 DEC 1958

CIA/SI 41-58
25 November 1958

CENTRAL INTELLIGENCE AGENCY

OFFICE OF SCIENTIFIC INTELLIGENCE

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Scientific Intelligence Report

THE YUGOSLAV ATOMIC ENERGY PROGRAM

NOTICE

The conclusions, judgments, and opinions contained in this finished intelligence report are based on extensive scientific intelligence research and represent the final and considered views of the Office of Scientific Intelligence.

CIA/SI 41-58
25 November 1958

CENTRAL INTELLIGENCE AGENCY
OFFICE OF SCIENTIFIC INTELLIGENCE

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PREFACE

This study supersedes the chapter on Yugoslavia in CIA/SI 92-56, *Nuclear Energy Activities in Foreign Countries, Volume II, Western Europe,* 22 October 1956, SECRET/NOFORN. It also covers estimated Yugoslavia uranium ore production. This study is based on information available as of 1 June 1958.

CONTENTS

Page

PREFACE iii

PROBLEM 1

CONCLUSIONS 1

SUMMARY 1

DISCUSSION 2

- Scope of the Yugoslav Atomic Energy Program 2
- Organizing and Financing the Program 3
  - Federal Commission for Nuclear Energy 3
  - Government Appropriations to the Atomic Energy Program 4
- Nuclear Physics Research Facilities 4
  - Boris Kidric Institute of Nuclear Sciences, Vinca . . . 4
  - Rudjer Boskovic Institute, Zagreb 5
  - Josef Stefan Institute, Ljubljana 5
  - Institute for the Technology of Mineral Raw Materials, Belgrade 5
  - Relationship of Institutes to Federal Government . . 5
- Operational Facilities 6
  - Uranium Mining 6
  - Uranium Milling 6
  - Uranium Refining and Conversion 6
  - Heavy Water 6
  - Reactors 6
  - Fissionable Material Processing 6
- Manufacture of Nuclear Equipment 6
  - Industrial Production 6
  - Production at the Institutes 7
- Nuclear Applications: Radioactive Isotopes 7
- Nuclear Training 7
  - Original Domestic and Foreign Training Programs . . 7
  - Recent Domestic Training Programs 8

CONTENTS (Continued)

Page

Foreign Collaboration 8
  General 8
  USSR 8
  United States 8
  Satellite Nations 9
  Other Countries 9
  International Organizations 9

APPENDIX — Key Personnel in the Yugoslav Atomic Energy Program 11

FIGURE

Following Page

1. Areas of Atomic Energy Activities in Yugoslavia . . . 2

THE YUGOSLAV ATOMIC ENERGY PROGRAM

PROBLEM

To assess the objectives and capabilities of the Yugoslav atomic energy program and the resources and facilities available to achieve these objectives.

CONCLUSIONS

1. Yugoslavia has a small atomic energy program which currently consists almost entirely of basic nuclear research. The more perceptible objectives of the program include the increased use of radioactive isotopes and the eventual use of nuclear propulsion for ships.

2. The organizations and facilities required for this limited program are available and can be expanded as needed.

3. Although originally interested in nuclear electric power, the Yugoslavs now realize that the application of nuclear electric power is not economically feasible in Yugoslavia, which has large amounts of untapped hydro-electric power resources.

4. Yugoslavia currently has no capability to produce nuclear weapons and probably will continue to devote its resources solely to the peaceful application of atomic energy.

5. Yugoslavia is dependent upon external aid to advance its atomic energy program and, currently, is receiving aid from the USSR and Western nations. Although Yugoslavia will probably continue to enlist the support of several countries, its program would not be adversely affected by reliance on only one country for aid.

SUMMARY

The Yugoslav atomic energy program as originally conceived provided for constructing, staffing, and equipping three nuclear research institutes. These institutes, now in operation in Vinca, Zagreb, and Ljubljana, are being provided with cyclotrons, accelerators, generators, a reactor, and the necessary electronic and chemical equipment to permit a wide latitude of basic nuclear research.

Imported radioactive isotopes have been in limited use for several years in Yugoslavia. Operation of the research reactor, due to begin at the end of 1958, will permit the production of a wide range of radioactive isotopes for use in industry, medicine, and agriculture. Centers for the control and distribution of isotopes are being established in many locations in Yugoslavia.

In 1957, Yugoslavia began preliminary studies of nuclear propulsion. Representatives of shipbuilding firms, other industry, and the nuclear research institutes have formed groups to study the proposed construction of a nuclear propelled vessel.

Although frequently expressing a desire for nuclear electric power plants, Yugoslavia has as yet made no plans for such construction. With large amounts of untapped hydro-electric resources available, the Yugoslavs recognize that it would be better to develop these resources than to construct nuclear power plants, which do not yet approach the economy of operation of hydro-electric plants.

Yugoslavia has, at this time, none of the plants which are required to produce weapons-grade nuclear material. Although provisions have been made for the production of a plutonium separation plant at Vinca, no progress has been made in attempts to obtain technical information and equipment from the Soviet Union for full-scale plutonium processing. Until such a plant is in operation, the irradiated fuel from the research reactor will probably be returned to the USSR, which will undoubtedly retain the plutonium.

Yugoslavia has received most of the hardware for its atomic energy program from the USSR while receiving isotopes and training from the West. However, the USSR has offered to train Yugoslav personnel, and the United States has offered to sign a research bilateral agreement which would permit the sale of hardware.

DISCUSSION

SCOPE OF THE YUGOSLAV ATOMIC ENERGY PROGRAM

In the immediate post World War II period, Yugoslavia took the initial steps in the development of an atomic energy program. At that time, there were very few Yugoslavs who were capable of making significant contributions to the nuclear sciences. These individuals had been trained in foreign countries, because prior to this time, Yugoslavia had no physics research institutes. The physics departments of the various universities were occupied almost solely with the training of basic physics teachers for secondary schools.

With this situation in mind, the Yugoslav atomic energy program was initially planned along three major lines: 1) constructing nuclear research institutes; 2) training nuclear scientists and specialists; and 3) finding the necessary raw materials and developing the processes to use this material.[1]

By 1955, these three objectives had in general been gained — three nuclear research institutes had been established and were in operation, numbers of scientists had been trained in foreign countries and within the Yugoslav institutes, and deposits of low-grade uranium had been located.

The second phase of the atomic energy program started with the establishment of a Federal Commission for Nuclear Energy. Under this Commission, the Yugoslav program was to concentrate on the further training of physicists and workers; equipping institutes with advanced equipment; increasing cooperation with foreign nuclear science institutes and organizations; performing basic research in atomic energy; and producing isotopes for use in agriculture, industry, and medicine.[1] Currently, these objectives are being accomplished and the Yugoslavs are beginning to investigate the production of nuclear materials.

Yugoslavia has also given thought to the possible uses of nuclear power and nuclear propulsion. According to a Yugoslav paper on power requirements presented at the Geneva Conference in 1955, a shortage of lignite for thermal power plants will develop in Yugoslavia by 1975. Even though by that

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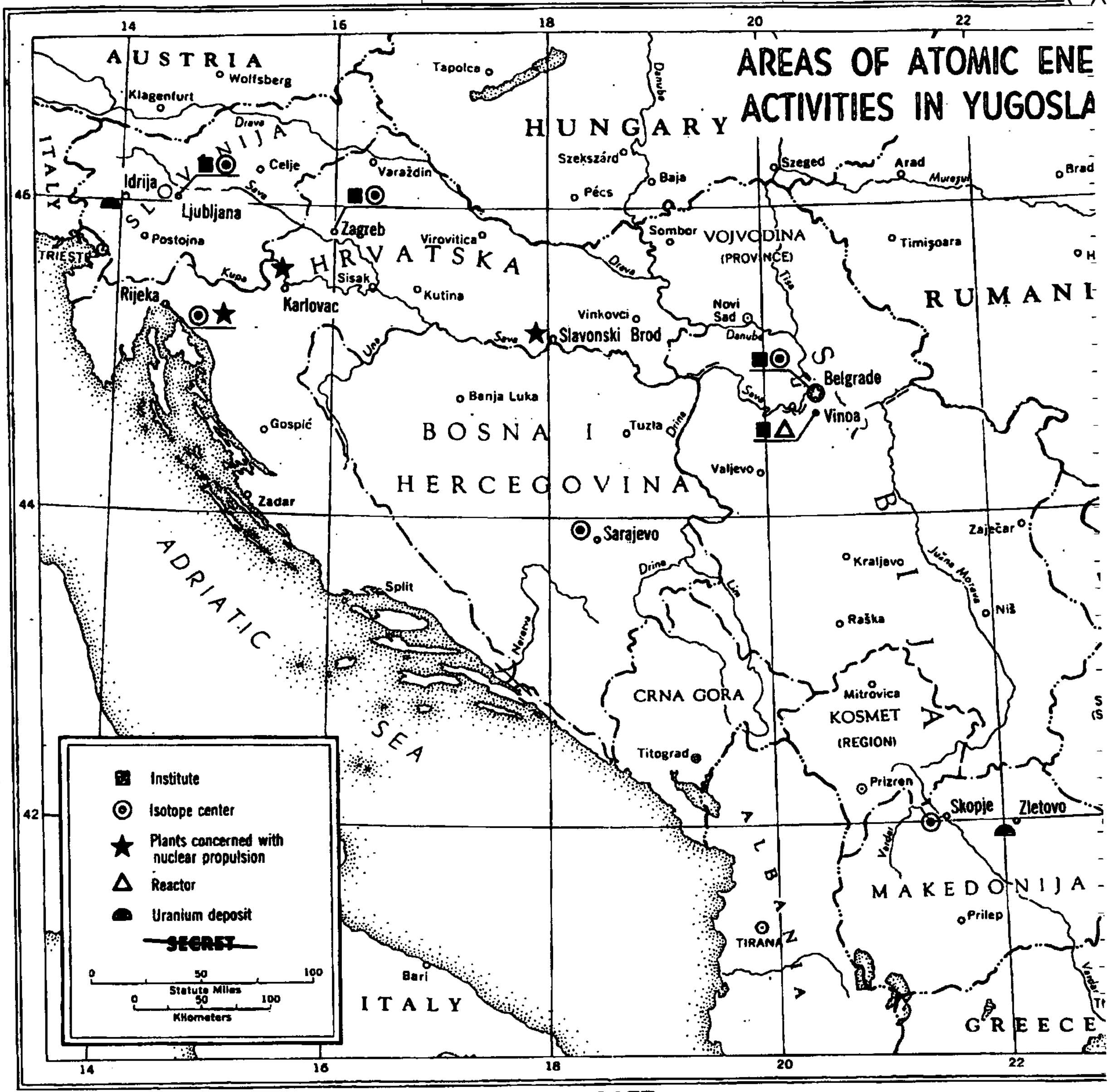

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time hydro-electric resources will be utilized only to the extent of 20 percent of capacity, it was suggested that nuclear energy would be used to fill the increasingly widening gap between the demand for power and the supply by conventional power facilities.[2] Further interest in nuclear power was demonstrated in September 1956, when a conference was held on the uses of nuclear energy for electric power. While one participant predicted that the first nuclear power plant would be constructed in Yugoslavia in 7 to 10 years, it was recognized that a great deal of research and industrial ground-work would be necessary before definite plans could be made.[3] Despite these predictions, the Yugoslavs now realize that it is both expedient and economical to develop unused hydro capacity before trying to initiate a large scale nuclear power program.

In the summer of 1957, the first efforts to develop nuclear propulsion in Yugoslavia were initiated. An investigating team composed of representatives from shipyards and other industry was assembled to begin studying the possibilities of the construction of nuclear powered ships.[4] Preliminary plans of this group called for the organization of a production pool to construct a ship of 40,000 to 50,000 tons displacement at the Treci Maj (3rd of May) Shipyard at Rijeka, with the Djuro Djakovic Plant at Slavonski Brod producing the reactors and the Jugoturbine Plant in Karlovac producing the turbines. This group also expressed a desire to send experts abroad for training and for studying the propulsion achievements of other countries.[28] In late 1957, the Federal Commission for Nuclear Energy began to consider the prospects for nuclear propulsion and decided: 1) that a systematic study of the problem should be made, and 2) that cooperation among the Commission, the Shipbuilding Institute at Zagreb, and the production pool at Rijeka should be established and maintained.[21, 29] It has been reported that in late 1957 and early 1958, the atomic section of the Treci Maj Shipyard was visited by members of the three Yugoslav nuclear physics institutes, by members of the Federal Commission, and by Soviet nationals associated with the reactor construction at Vinca.[30–32]

ORGANIZING AND FINANCING THE PROGRAM

Federal Commission for Nuclear Energy

On 19 March 1955, a decree of the Federal Executive Council of Yugoslavia established the Federal Commission for Nuclear Energy. This decree stated the following objectives:

"(1) The Commission shall help, coordinate, and direct the work on development of nuclear sciences and conduct all work in applied sciences in this field.

(2) The Commission shall:

a) introduce the plan of work in the development of nuclear energy and undertake measures for its implementation;

b) fix requirements in connection with the development and utilization of nuclear energy at the time of the framing of the Federal Social Plan and the Federal Budget and submit proposals to the Federal Executive Council for these purposes;

c) prepare the draft estimate of revenues and expenditures of the Commission.

(3) Within the framework of its tasks, the Commission shall maintain and develop connections with corresponding organizations and institutes in foreign countries."

Alexander Rankovic, vice president of the Federal Executive Council, was appointed president of the Commission. At the same time, two vice presidents, a secretary, and eleven members were appointed. The president, the two vice presidents, the secretary, and three of the eleven members were named to the presidium of the Commission to execute the orders of the whole Commission.[6] In May 1957, an additional member was added to the presidium and the number of members not on the presidium was increased to 17.[7]

To accomplish the functions assigned to it, the Commission has set up various organizational units to study problems connected with the work of the Commission, apply the acts of the Commission, supervise the establishments that execute tasks assigned by the Commission, and issue resolutions on duties within the scope of the Commission. These organizational units are as follows: the Directorate of Nuclear Raw Materials; the Section for Scientific Research; the Section for the Production and Application of Atomic Energy; the Division for Contacts with Foreign Countries; the Division for Protection from Radiation; and several administrative divisions.[6]

Government Appropriations to the Atomic Energy Program

Prior to 1957, there were no provisions in the Yugoslav federal budget specifically earmarked for atomic energy. The Yugoslav federal budget for 1957, however, provided 3.5 billion dinars (approximately $5,950,000) for the "development of nuclear energy."[8] The State Secretary for Financial Affairs has announced that the 1958 budget will include 5 billion dinars (approximately $8,500,000) for the "peaceful uses of atomic energy."[9]

Western observers who have visited the three major nuclear physics institutes in recent years have commented that these institutes, in comparison with other Yugoslav institutes and universities, seem to have a great deal of money available for training, equipment, and physical plants. This money seems to be available in both dinars and foreign exchange. Since it has become easier to deal with the West in recent years, the Yugoslavs have purchased from Western manufacturers top quality complex instruments and equipment that they could not produce themselves.[10 18]

NUCLEAR PHYSICS RESEARCH FACILITIES

Boris Kidric Institute of Nuclear Sciences, Vinca

This is the oldest and largest of the three main nuclear research institutes. It was established as an independent institute in 1947 by a resolution of the Federal Government. It was directed by Stephan Dedijer until 1954, when he was replaced by the current director, Vojko Pavicic. Pavle Savic, one of the best known Yugoslav physicists, is the president of the scientific council of the institute.

The institute is organized into the following divisions: Nuclear Reactors; Control of Reactors; Fission Products; Nuclear Impurities; Production and Practical Use of Radioactive Isotopes; Radiation Chemistry; Optical Methods; Nuclear Metallurgy; Electromatic Separation and Mass Spectroscopy; Physical and Chemical Separation of Isotopes; Accelerators; Electronics; Theoretical Physics; Protection from Radiation; Design; Technical; Maintenance; Planning; and Documentation.

Major equipment in operation at the institute includes a 0.2 Mev Van de Graaff generator, a 1.5 Mev Cockroft-Walton accelerator, a 60 curie cobalt 60 source, a mass spectrograph, a 120 channel analyzer, and a critical assembly.

On 17 May 1958, Tito officiated at the opening ceremony attending the operation of the critical assembly.[33] This facility was designed and built by the Yugoslavs but uses natural uranium and heavy water provided by the Soviets under the Soviet-Yugoslav agreements on nuclear energy.[34] According to one source, the pile contains 2 metric tons of natural uranium and 6 metric tons of heavy water.[35]

Still under construction at the institute is the 7 to 10 MW (thermal) research reactor purchased from the Soviet Union, also under the Soviet-Yugoslav agreements on nuclear energy. This reactor is of the material test type and is designed to have a maximum thermal flux of $8 \times 10^{11} n/cm^2/sec$.[11] It has been reported, however, that a maximum thermal flux of $5.5 \times 10^{13} n/cm^2/second$ is expected.[37] The reactor is to be heavy water moderated and cooled and to use 2 percent enriched uranium in the form of aluminum clad tubes. The reactor tank and the main heavy water cooling system are stainless steel. Secondary cooling is provided by water pumped from the Danube and circulated through double-tubed heat exchangers.[11] The total weight of the heavy water coolant and moderator is 7 metric tons. One fuel loading of the 2 percent enriched uranium consists of 69 fuel elements at start-up. When fully poisoned, 83 fuel elements are required. The actual mass at start-up is 285 kilograms and when fully poisoned is 340 kilograms.[35–37] Originally scheduled for completion in 1957, it has now been stated by the secretary of the Nuclear Energy Commission that the reactor will be completed by the end of 1958.[12] In the first quarter of 1958, however, deliveries by the USSR were several months behind schedule and the current strained relationship between Yugoslavia and the USSR may delay completion even longer.[47]

At the Boris Kidric Institute, research is also carried out on many subjects associated with nuclear physics, among these are basic nuclear physics, effects of radioactivity, uranium ore separation, radioactive material processing, and reactor design.

This institute has been visited many times by Western scientists who have been permitted to inspect all of the institute with the exception of the warehouses containing Soviet reactor equipment and materials; however, recent information indicates that security measures have been increased.[18]

Rudjer Boskovic Institute, Zagreb

This institute was established by the Federal Government in 1951. Velimir Novak is director of the institute and Professor Ivan Supek is president of the administrative council and a member of the scientific council. The institute is organized into three major divisions: Accelerators, Electronics, and Reactors. These divisions and their various subdivisions perform research on biochemistry, heavy water, fissionable material processing, and associated subjects.[6] The major piece of equipment at Zagreb is a 16 Mev cyclotron that is nearly completed. An electron microscope and a neutron generator are currently in use, and a pilot plant for the separation of uranium ore is in operation.[10]

Josef Stefan Institute, Ljubljana

The Josef Stefan Institute was originally founded in 1947 as an institute for physics of the Slovenian Academy of Sciences. It was later taken over by the Federal Government and enlarged as an independent institute. The director of the institute is Karol Kajfez and the president of the administrative council is Dr. Anton Peterlin. This institute is organized into a series of laboratories: Analytical, Materials, Uranium and Hexafluoride, Heavy Water, Uranium Concentration, Mass Spectrometry, Electronics, Reactor Measurements, Radio Biochemistry, Organic Chemistry, Accelerators, and Nuclear Physics.[6] Major equipment at Josef Stefan consists of a 2 Mev Van de Graaff accelerator and a 31 Mev betatron.[10]

One of the major problems assigned to this institute is research on the production of heavy water. Also under study are certain nuclear reactor problems and analytical methods of quantitative determination of the uranium content of ores.[14]

Institute for the Technology of Mineral Raw Materials, Belgrade

This institute was established by the Federal Executive Council in June 1955. Although only indirectly concerned with nuclear physics, it is directed and controlled by the Federal Commission for Nuclear Energy, which also designates the top administrative personnel. Currently, Engineer Bela Bunji is director, and Engineer Milan Jovanovic is president of the administrative council. This institute is responsible for the improvement of known processes and the development of new processes for obtaining nuclear fuels from raw materials. It is also responsible for the establishment of industrial production of nuclear raw materials.[6]

Relationship of Institutes to Federal Government

All four of the above institutes have some features in common. All are controlled and directed by the Federal Commission for Nuclear Energy. The Commission appoints the directors and members of the scientific and administrative councils of the institutes, and representatives of all four institutes are among the members of the Commission. As independent institutes, all are financed directly by the Federal Government and are associated with their neighboring universities only through leading personnel who hold positions in both the institutes and universities.

OPERATIONAL FACILITIES

Uranium Mining

In 1952, at the request of the Yugoslav government, a geologist of the U.S. Geological Survey made a field examination of numerous suspected uranium deposits in Yugoslavia. The two most promising deposits at that time were the Idrija mercury deposit in Slovenia and the Zletova lead-zinc mine in Macedonia. At these mines, low-grade uranium might be recovered as a byproduct from ores believed to have an average uranium content of 0.01 percent. The geological setting of much of Yugoslavia, particularly Serbia and Macedonia, is favorable for uranium mineralization, and the Yugoslavs are presently systematically prospecting for radioactive materials. It is not known at this time how much ore is being obtained, but it is estimated that the Yugoslavs are mining annually sufficient ores to contain about 100 tons of recoverable uranium metal.

Uranium Milling

Pilot plant production of U_3O_8 has been proceeding for several years in Yugoslavia. The Federal Commission for Nuclear Energy considers that the results achieved will permit them to construct major uranium mills "in the coming years." [15]

Uranium Refining and Conversion

No plants for the production of uranium salts or metals are in operation in Yugoslavia. Research on the processes involved is being done at the institutes at Vinca, Ljubljana, Zagreb, and Belgrade.[6] [10] In 1957, the Institute for the Technology of Mineral Raw Materials contacted a U.S. firm regarding the engineering, design, and procurement of equipment and materials for a uranium metal pilot plant with a capacity of 20 tons per year to be erected in Yugoslavia. The U.S. firm submitted a proposal for this plant but it has not as yet been accepted or turned down.[17]

Heavy Water

No heavy water production facilities are in operation in Yugoslavia. The Josef Stefan Institute, however, has done laboratory scale work on the separation of D_2O by fractional distillation, slow evaporation, and cascade electrolysis.[10]

Reactors

Other than the exponential pile at Vinca, the only reactor in Yugoslavia is the 7 to 10 MW material test reactor currently under construction at Vinca. No other reactors are known to be scheduled for construction.

Fissionable Material Processing

No plants for the extraction of plutonium and fissionable materials from irradiated fuel elements are in operation. Provisions have been made for the construction of a separations plant adjacent to the reactor at Vinca; but, as of June 1957, the construction of this building had not begun.[11] Yugoslav requests for technical information and equipment for full scale plutonium processing from the Soviet Union have been refused; however, the Soviets have promised to give advice on the laboratory processing of plutonium that is being done at Vinca and Zagreb.[6]

MANUFACTURE OF NUCLEAR EQUIPMENT

Industrial Production

Under the current Yugoslav program, few plants have been required to produce nuclear equipment. The one plant most frequently mentioned is the Rade Koncar Electric Equipment Plant in Zagreb. This plant has produced much of the electrical equipment for the various institutes and supplied many parts for the 16 Mev cyclotron at Zagreb.[18] In connection with the future use of nuclear propulsion for ships, it has been announced that the Djuro Djakovic Plant in Slavonski Brod will produce nuclear reactors.[19]

Production at the Institutes

In the years when the various institutes were being established and equipped, it was virtually impossible to import Western instruments and equipment due to foreign exchange limitations and trade restriction. As a result, the workers of the institutes had to produce much of their own equipment. Each institute has a well-equipped workshop where nearly all equipment is produced. At the Rudjer Boskovic Institute, for instance, Geiger-Mueller tubes are produced for all three institutes and many of the parts for the cyclotron were made. At the Boris Kidric Institute, the scientists and technicians constructed their own mass spectrograph, 120 channel analyzer, and Cockroft-Walton generator.[10]

NUCLEAR APPLICATIONS: RADIOACTIVE ISOTOPES

Radioactive isotopes have been used for several years in Yugoslav industry, medicine, and research. The majority of these isotopes were purchased from the U.K. facility at Harwell; some were purchased from the U.S. AEC; and a few were produced by the accelerators in operation in Yugoslavia.[20, 23] In 1956, it was realized that the increased use of isotopes and the attending procurement and distribution tasks would create many problems if definite controls and procedures were not established. Thus in 1957, the Federal Commission for Nuclear Energy established a fund for the purchase of isotopes and made certain regulations to be complied with before an institute, industrial enterprise, or hospital could receive isotopes. Simultaneously, the Commission provided for the establishment of various isotope "centers." Centers for the industrial uses, primarily defectoscopy (use of radioactive isotopes to defect faults in weldings and castings), have been set up Belgrade, Sarajevo, Ljubljana, and Rijeka. The first center for the application of isotopes in medicine was established in Belgrade, and similar centers are planned for Zagreb, Ljubljana, Sarajevo, and Skoplje. Centers for agricultural applications are planned for Belgrade, Zagreb, and Ljubljana.[21, 23]

NUCLEAR TRAINING

Original Domestic and Foreign Training Programs

Domestic training in the nuclear sciences in Yugoslavia so far has been provided primarily through the operation of the three nuclear physics institutes. Young scientists and technicians at these institutes, through on-the-job training and associated courses at the neighboring universities, have received a basic education in nuclear physics. For more advanced training, these scientists and technicians have been sent to various facilities in foreign, generally Western, countries. Approximately 20 Yugoslavs have studied in the United States at such places as the AEC's Oak Ridge Institute of Nuclear Studies, the AEC's International School of Nuclear Science and Engineering at Argonne National Laboratory, and at various universities. Approximately 10 Yugoslavs have studied in France, Belgium, Denmark, and Sweden. While it has been reported that the engineers scheduled to operate the Vinca reactor would be sent to the USSR for training, only one is definitely known to have returned to Yugoslavia after taking a course in reactor operation.[11, 24]

The Yugoslavs prefer training in the West rather than in the USSR for several reasons. Yugoslav officials have stated that in the West much more information was available to the students; the USSR, they say, has withheld information as classified that would be completely open in the West. An additional factor is the frequent change in the political relationship between the USSR and Yugoslavia. Several times in the past, a Yugoslav has gone to the USSR during a period of good relations and then been forced to remain idle or return home when political relations cooled.

Recent Domestic Training Programs

As more of the scientific apparatus and equipment nears an operational point and the Yugoslav program expands, the shortage of trained scientists and technicians is again becoming acute. A program of training at various Yugoslav institutes and universities has recently been initiated in an attempt to train the numbers of scientists and technicians who will be required to carry out the expanding nuclear energy program.

In 1956, the Boris Kidric Institute established an isotope training school. The course, which lasts for 7 to 8 weeks, covers all aspects of the use of isotopes, from the study of radiation effects on living organisms to defectoscopy. In 1957, 105 persons attended the school, and about 130 were due to attend in 1958.[25]

In October 1957, the Rudjer Boskovic Institute, in cooperation with the University of Zagreb, began a post-graduate program in nuclear physics. Among the subjects to be covered were electricity; inorganic, structural, and radionuclide chemistry; and the chemistry and biology of radiation. In the first year, 48 students are due to graduate from this program.[26]

During the 1958–1959 academic year, the University of Zagreb plans to establish a Division of Technical Physics and Nuclear Technology. A variety of subjects in the nuclear sciences will be offered in a course lasting several years.[27]

FOREIGN COLLABORATION

General

The Yugoslavs have sought assistance from both the East and the West in the development of their atomic energy program. The need for external help has been recognized by the Yugoslavs since the beginning of their interest in atomic energy, and funds were quickly made available by the Government to send students to work in many of the nuclear centers of the world. During the period immediately following World War II, promising young scientists were sent to nuclear research institutes in Western Europe and the United States. With the Soviet agreement of January 1956, the Yugoslavs turned to the East for assistance in obtaining the hardware needed for their program.[41] Although this agreement also provided for students to be trained in Soviet institutes, there has been continued dependence on Western facilities for most advanced nuclear training.[40]

USSR

From the pure "hardware" point of view, the Soviets have provided the Yugoslavs with an impressive amount of aid. The USSR provided the research reactor now under construction at Vinca and also agreed to provide natural and enriched uranium and heavy water for both the reactor and the critical assembly which the Yugoslavs constructed themselves. All of this equipment and material was purchased from the Soviets after many negotiations regarding the price, which the Yugoslavs regarded as excessive. By purchasing the equipment and materials the Yugoslavs hoped to limit the number of "strings" attached to the Soviet agreement.[39]

The Soviets have refused to give the information or direct assistance needed to construct a chemical processing plant to handle irradiated fuel elements from the Yugoslav reactor. They did agree, however, to provide the equipment for a hot and semi-hot chemical laboratory.[35] [36] Such equipment, in effect, gives the Yugoslavs the capability to develop a chemical separations process.[38]

United States

The Yugoslavs originally attempted to obtain a research reactor from the United States but turned to the USSR because of U.S. insistence on the inclusion of "safeguard" provisions (ones ensuring only peaceful uses) in any bilateral agreement. Although unwilling to agree to the terms of a bilateral agreement with the United States, Yugoslavia has continued to send students to the U.S. AEC atomic training centers at Argonne and Oak Ridge. Recently, the use of U.S. training facilities was opposed by some officials in Yugoslavia, and a policy appears to have been established that provides that students will be sent to the United States only when equivalent training cannot be obtained in European centers.[41] The major factor behind this policy is apparently the higher travel and living expenses in the United States as compared to Europe. In spite of earlier failures to obtain hardware in the United States, the Yugoslavs have shown recent interest in obtaining information on uranium treatment and in purchasing experimental and power reactors.[45]

Satellite Nations

Before the fall of 1956, there was little interchange between Yugoslav and Satellite scientists. Since then, there have been fairly extensive exchanges, particularly with Poland and Czechoslovakia. A Yugoslav delegation traveled to Czechoslovakia in November 1956 where they reportedly received a cool official reception but had satisfactory relationships on a scientist-to-scientist basis.[35] On 5 January 1957, the Yugoslavs announced that an agreement had been reached, with a Polish delegation visiting Yugoslavia on cooperation in the exploitation of nuclear power for peaceful purposes. The agreement calls for cooperation in research in the use of radioactive isotopes in industry, agriculture, medicine, and biology and the exchange of experiences in geological research and technology concerning nuclear raw materials.[44] The initiative was apparently on the part of the Poles, as the Yugoslavs feel that the Poles have little to offer.[41]

Other Countries

Yugoslavia has shown interest in making contacts in the nuclear field with many nations. In addition to countries already mentioned, Yugoslav students are studying or working in institutes in Germany, Denmark, the UK, France, and Sweden.[41] Yugoslavia has held several international physics conferences, among which was a conference in July 1957 with participation by representatives from France, Italy, Sweden, the USSR, West Germany, Poland, Finland, and Israel.[42] In June 1957, the Secretary General of the Egyptian AEC visited Yugoslavia.[46] In December 1957, Pavle Savic visited Delhi for the announced purpose of getting acquainted with India's activities in the atomic energy field and to strengthen contacts between the Yugoslav and Indian nuclear research organizations. Savic's visit was in return for an earlier one to Yugoslavia by India's Secretary of the Department of Atomic Energy. In a press statement, Savic indicated that Yugoslavia has agreements with the USSR, Poland, France, Greece, and Egypt for cooperation in the field of atomic research. He stated further that Yugoslavia was prepared to sign similar agreements with other countries.[14]

International Organizations

Yugoslavia is a member of CERN (European Organization for Nuclear Research) and in December 1956 was elected to the Committee of the Council of CERN.[43] Representatives from Yugoslavia took part in the Conference on the Statute of the International Atomic Energy Agency in New York in 1956, and on 17 September 1957, Yugoslavia ratified the Statute and thus became a member of the Agency.

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Yugoslavia: Prospects for Nuclear Power Development [redacted] (b)(3)

The future of nuclear energy in Yugoslavia, once bright, is now uncertain. Growing and unusually broad-based antinuclear sentiment has forced Belgrade to put on hold plans to build several nuclear plants, including a $2.5 billion plant in Croatia on which US and other foreign firms are bidding. Chances are still better than even that the Croatian plant ultimately will be approved. But the decision probably will come only after lengthy study and could cause further controversy among both the leadership and the public. [redacted] (b)(3)

Current Status

Yugoslavia's nuclear power development program, in particular, plans to build its second nuclear plant at Prevlaka near the Croatian capital of Zagreb, has been sidetracked but not derailed. Pronuclear forces, previously virtually unchallenged, have suffered serious setbacks. Several regional bodies have eliminated or postponed commitments to nuclear plants. [redacted] (b)(3)

Moreover, the issue has been bucked up to the federal level, where a special new commission reportedly has been formed to reexamine nuclear power in the context of the country's long-term energy development plans. Premier Branko Mikulic and top leadership bodies in recent weeks have indicated that no plants will be approved until the government finishes its study. [redacted] (b)(3)

Nonetheless, the program is far from dead. The nuclear lobby remains a potent force, relatively few top officials have rejected the nuclear option, and the review of bids and other preliminary work for Prevlaka is continuing. Mikulic has noted that one of the purposes of the commission is to provide a cooling off period. The complex series of agreements among governmental and economic organizations to build the plant also remain intact. [redacted] (b)(3)

The successful operation of the country's first nuclear plant, built by Westinghouse in the Slovenian town of Krsko, is an argument used by nuclear proponents [redacted] (b)(3)

Yugoslav Source ©

Prevlaka was to be the first of a four-unit series of 1,000 megawatt plants—following the opening in 1982 of the country's first 664 megawatt plant built by Westinghouse in Krsko, Slovenia—with the possibility of an eventual seven to 11 plants nationwide. The $2.5 billion Prevlaka plant was planned to be built by a consortium of utilities from Croatia, Slovenia, and possibly Vojvodina. Construction was originally slated to begin in mid-1988 with commercial output beginning in 1995, but that timetable has continued to slip. Bidders include firms from the United States, France, Great Britain, West Germany, Canada, Japan, and the USSR. [redacted] (b)(3)

Pronuclear Lobby

If Prevlaka is approved, it will be thanks to a hardcore of pronuclear officials motivated by both conviction and self-interest. They consist of scientists, academics, and—even more vocally and visibly—regional and federal energy officials, utility officials, and industrial organizations producing power equipment. They tend to draw their strength from three common arguments:

- Yugoslavia is an energy deficient and import dependent country with no viable domestic long-term energy alternatives to nuclear power.

- The decision to develop nuclear power has been legitimized through a series of accords between regions, industries, and various layers of government—in keeping with the country's traditional system of economic decision making—and verified through national economic programs based on economic and scientific analysis.

- The successful operation of the Krsko plant demonstrates the safety, reliability, and efficiency of nuclear power.[redacted] (b)(3)

Though recently thrown on the defensive, pronuclear officials employ hard-hitting charges in rebutting their critics. They argue that safety and environmental concerns often have been used as a smokescreen by groups motivated more by political or economic interests. They maintain that those regions not slated for nuclear plants, mostly in the poorer south, are simply jealous or fearful that the country's limited capital must by necessity be committed to selected republics. They accuse opponents and the press of spreading grossly inaccurate data concerning cost and safety, trying to create an atmosphere of hysteria.[redacted] (b)(3)

Circumstantial evidence suggests that nuclear advocates and their sympathizers may be more numerous than their current visibility suggests. Antinuclear activists continue to characterize them as a strong and determined force. Few advocates have been known to retract their commitment to nuclear power in the face of the protest wave. And support for increased energy supplies from any sources could increase if a hard winter approaches and utility companies resort to electricity brownouts.[redacted] (b)(3)

Antinuclear Forces

The pronuclear lobby, however, faces a formidable opponent in the form of unusually widespread antinuclear sentiment. The breadth of opposition to an established government policy such as nuclear power in fact is unprecedented in recent years as is the success of nuclear opponents in gaining a reassessment of the energy program.[redacted] (b)(3)

The antinuclear forces, though largely uncoordinated, consist of a number of disparate groups with normally unrelated interests. They include several regions that have sufficient energy resources of their own, some official youth organizations, parts of the scientific community and the media, the public at large, veterans, and apparently some circles within the military.[redacted] (b)(3)

Regardless of the latest furor, antinuclear agitation in itself is nothing new and even has won some modest victories. The decision to locate the current plant at Prevlaka, for instance, came about only after plans to build it on the Adriatic Coast near Zadar were upset in 1979. Local officials maintained a reactor would threaten the area's tourism industry. Opposition to nuclear power was strong and growing even before the Chernobyl accident. Nonetheless, Chernobyl gave antinuclear forces important new impetus, especially when the regime ordered—and the media publicized—preventive measures against radioactive fallout affecting most of Yugoslavia.[redacted] (b)(3)

Several common themes run through Yugoslav antinuclear sentiment, cutting across the diverse groups. One is that new nuclear plants are financially unsound. Critics argue that building four new plants would double the country's $20 billion foreign debt and compromise the nonaligned country's economic and political independence. They assert that foreign credits to build even the Krsko plant so far have not been repaid, only rescheduled. Another is that they are unnecessary, since the country purportedly has sufficient untapped alternative domestic coal and water resources. And, especially since Chernobyl, there has been a growing belief that they pose a real threat to the public's safety and the environment.

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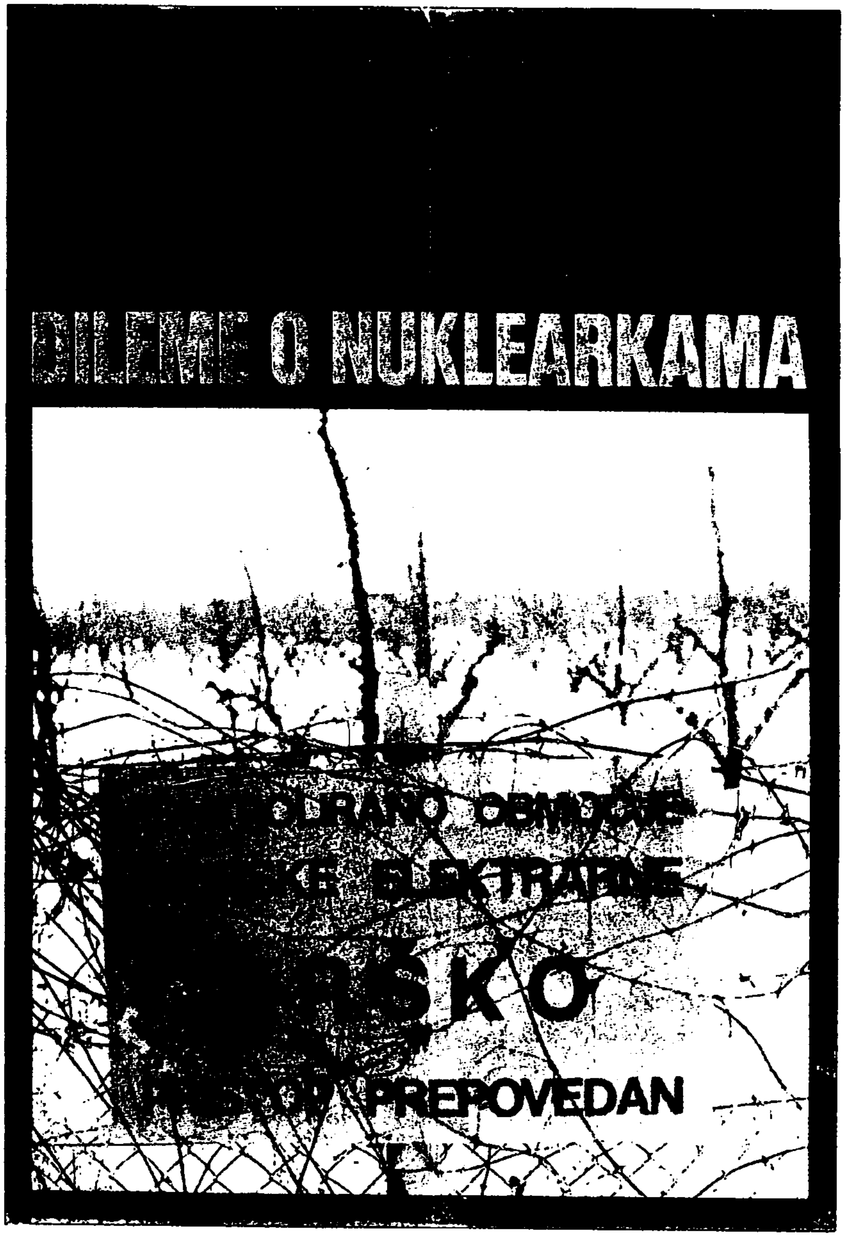
Outlook

The leadership seems to be playing for time, hoping that antinuclear sentiment eventually will subside and a decision on Prevlaka, pro or con, can be made on practical economic and other grounds. The regime



Antinuclear views have received ample coverage in the press, including this Zagreb magazine feature on the nuclear debate.

DANAS

Antinuclear Pressure Groups

Following are some of the key antinuclear pressure groups and outlines of their motives and impacts:

Regional Interest Groups. *Interest groups from several regions have cause to be unsupportive of, and even antagonistic to, Prevlaka. Serbia, Kosovo, and Premier Mikulic's home republic of Bosnia-Hercegovina each have substantial untapped coal resources of their own and a vested interest in further developing alternative energy sources in their own regions. Even Slovenia, a junior partner in Prevlaka, is only lukewarm about the project, US diplomats have reported.* [redacted] (b)(3)

Youth Groups. *Some youth groups have been among the most vocal and visible opponents of nuclear plants. The official youth group in Slovenia, the country's most Westward-looking and tolerant republic, has come out against nuclear energy. Members of Croatia's youth group have protested the lack of say on nuclear planning and have discussed staging sit-ins at Prevlaka with their Slovene counterparts. Some 70,000 Serbian youth reportedly signed an antinuclear petition.* [redacted] (b)(3)

Military. *Some evidence suggests that circles within the military have reservations about nuclear power. One military commentator in March warned that nuclear plants would make Yugoslavia more dependent on big powers and could be vulnerable to attack even from small Balkan neighbors. Nikola Ljubicic, a Serbian leader and ex-defense minister, also has spoken against nuclear power.* [redacted]

Veterans. *The veterans, a conservative and vociferous pressure group, called for the suspension of all new nuclear plants at a congress in June. Individual delegates—including some from Croatia—protested a lack of public voice on nuclear planning and warned that Yugoslavia could become a nuclear waste disposal dump.* [redacted] (b)(3)

Scientific Community. *The experts seem sharply divided over the safety and appropriateness of nuclear plants. Many scientists and engineers reportedly have signed antinuclear petitions sent to national leadership bodies.* [redacted] (b)(3)

Public at Large. *The antinuclear issue has strong appeal to the man in the street. A public opinion poll taken at about the time of Chernobyl found that 75 percent of adult respondents nationwide believed nuclear plants are unnecessary, and an "absolute majority" asserted that they are environmentally more threatening than other power plants.* [redacted] (b)(3)

The Media. *Some of the country's increasingly freewheeling media have seized on nuclear power to sell papers and mold opinion. The press gave extensive, largely unvarnished coverage to the Chernobyl disaster and has reported openly and often sympathetically on the views of nuclear opponents.* [redacted] (b)(3)

Courts. *The nuclear program may hit a legal snag. The country's Constitutional Court reportedly has begun to examine whether the issue falls within its competence. The court flexed its muscle last year when it ruled unconstitutional another established government policy on foreign exchange.* [redacted] (b)(3)

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USB/ |SNIE 4-1-74

[illegible]. Intell Program

~~Secret~~

[redacted] (b)(3)

MEMORANDUM TO HOLDERS

SPECIAL NATIONAL INTELLIGENCE ESTIMATE

Prospects for Further Proliferation of Nuclear Weapons

~~Secret~~
SNIE 4-1-74
[redacted] (b)(3)
18 December 1975 (b)(3)

Copy Nº 185

[redacted]

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MEMORANDUM TO HOLDERS OF

SNIE 4-1-74

PROSPECTS FOR FURTHER PROLIFERATION OF NUCLEAR WEAPONS

~~SECRET~~

THIS MEMORANDUM IS ISSUED BY THE DIRECTOR OF CENTRAL INTELLIGENCE.

THE UNITED STATES INTELLIGENCE BOARD CONCURS, EXCEPT AS NOTED IN THE TEXT, AS FOLLOWS:

The following intelligence organizations participated in the preparation of the estimate:

The Central Intelligence Agency, the intelligence organizations of the Departments of State, Defense, and Treasury, the National Security Agency, and the Energy Research and Development Administration.

Concurring:

The Deputy Director of Central Intelligence representing the Central Intelligence Agency

The Director of Intelligence and Research representing the Department of State

The Director, Defense Intelligence Agency

The Director, National Security Agency

The Special Assistant to the Secretary for National Security, Department of the Treasury

The Deputy Assistant Administrator for National Security, Energy Research and Development Administration

Abstaining:

The Assistant Director, Federal Bureau of Investigation

Also Participating:

The Assistant Chief of Staff for Intelligence, Department of the Army

The Director of Naval Intelligence, Department of the Navy

The Assistant Chief of Staff, Intelligence, Department of the Air Force

CONTENTS

Page

PRECIS 1

DISCUSSION 3

I. INTRODUCTION AND REAFFIRMATION OF SNIE 4-1-74 3
  A. New Estimates 4
  B. Key Technical Considerations 4
  C. Uncertainties and Principal Determinants 5
  D. National Objectives in Developing a Nuclear Device 6

II. EARLIEST DATES OF THE TECHNICAL FEASIBILITY OF POSSESSION OF A NUCLEAR DEVICE 6
  A. The Republic of China 6
  B. Pakistan 8
  C. South Africa 8
  D. The Republic of Korea 9
  E. Other Countries 9

PROSPECTS FOR FURTHER PROLIFERATION OF NUCLEAR WEAPONS

PRECIS

We reaffirm the major judgments of SNIE 4-1-74 which addresses the problem of prospects for further proliferation of *nuclear weapons*. It is concluded in the SNIE that in the 1980s the production of nuclear weapons will be within the technological and economic capabilities of many countries but that the principal determinant of the extent of nuclear weapons proliferation in the coming years will be political considerations.

This Memorandum to Holders addresses the concept that some countries might seek to further their political, and even military, objectives by the acquisition of a very modest *nuclear explosive* capability without time-consuming "weaponization" efforts. It concludes that there are a number of countries that could accumulate sufficient fissionable material, complete the necessary nuclear explosive research and development work, and thus be in a position to fabricate a nuclear explosive device without having violated the letter of the safeguard provisions of the IAEA or NPT. The fabrication could take no more than a few days. In virtually all cases, taking this step would involve the violation of safeguard agreements.

The earliest technically feasible dates when various countries could have a nuclear device in hand are shown in Table 1, page 6. The dates are based on *technical capability*. They are not dates considered probable. Any attempt to actually fabricate and/or test a nuclear device will come only after the country has considered the political and strategic situation and is desperate enough to accept the consequences of abrogating safeguard agreements.

In most cases, the fabrication of nuclear *devices* is referred to in SNIE 4-1-74 as a step in a program aimed at the production of *nuclear weapons*. The level of effort and the amount of time required to produce *weapons* that are the focal concern of the SNIE would be greater than that needed to fabricate the *devices* referred to in this Memorandum. Thus one cannot necessarily compare the *device or weapon* dates given in the SNIE with the earliest technically feasible dates for *devices* in this Memorandum. Here we are concerned with single, unweaponized nuclear explosives. Since they in themselves may have a political impact, they may be the ultimate goal of the program.

DISCUSSION

I. INTRODUCTION AND REAFFIRMATION OF SNIE 4-1-74

1. SNIE 4-1-74 of August 1974 addresses the problem of the prospects for further proliferation of nuclear weapons. We reaffirm the major judgments that it contains. Still valid is its discussion about the "barriers" to proliferation, including the technological requirements for developing a nuclear explosive and the international restrictions such as the safeguards of the International Atomic Energy Agency (IAEA) and provisions of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT).

2. The major judgments of SNIE 4-1-74, in essence, are:

- In the 1980s, the production of nuclear weapons will be within the technological and economic capabilities of many countries. The principal determinant of the extent of nuclear weapons proliferation in coming years will, however, be political considerations—including the policies of the superpowers with regard to proliferation, the policies of suppliers of nuclear materials and technology, and regional ambitions and tensions.
- It is likely that India will proceed to fabricate weapons covertly. But the US or the USSR still might be able to dissuade its leaders. An Indian decision to proceed with an overt weapons program on any scale will be one factor inclining some other countries to follow suit.
- A large collection of fragmentary and partly circumstantial evidence leads us to believe that Israel already has produced nuclear weapons. We do not expect the Israelis to provide confirmation of widespread suspicions of their capability, either by nuclear testing or by threats of use, short of a grave threat to the nation's existence.
- It would require very fundamental changes, such as the breakup of major defense alliances accompanied by a substantial increase in strife and tension throughout the world, to induce countries like West Germany, Sweden, Canada, and Italy to exercise their near-term capability.
- The Director of Central Intelligence, the Central Intelligence Agency, the Department of State, and the Assistant Chief of Staff for Intelligence, Department of the Army believe that Japan would not embark on a program of nuclear weapons development in the absence of a major adverse shift in great power relationships which presented Japan with a clear-cut threat to its security.[1] The Director of Naval Intelligence, Department of the Navy, and the Assistant Chief of Staff, Intelligence, De-

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[1] The Energy Research and Development Administration now associates itself with this position. The Defense Intelligence Agency was associated with this position, but it is now associated with the position of the Director of Naval Intelligence, Department of the Navy, and the Assistant Chief of Staff, Intelligence, Department of the Air Force. See the SNIE for the development of this position and for the expansion of these and the other judgments.

partment of the Air Force, see a strong chance that Japan's leaders will conclude that they must have nuclear weapons if they are to achieve their national objectives in the developing Asian power balance. Such a decision could come in the early 1980s.

— Less sweeping changes could induce one or another of the less-advanced nations to mount the sort of nuclear effort India and Israel have made.

A. New Estimates

3. The possibility that some countries might seek to further their political and even military objectives by the acquisition of a very modest nuclear explosive capability, without time-consuming "weaponization" efforts, is referred to in SNIE 4-1-74 (see Conclusion J), but it is not explored in depth. In the past year, additional analysis has refined estimates about the facilities and the time that are required for development of an unweaponized device by certain countries. This Memorandum to Holders is intended to supplement the SNIE by presenting the estimates derived from the results of this analysis. The criteria used in making these estimates are:

(a) a *nuclear device* based on the possession of about 10 kilograms or more of chemically separated plutonium [2] or a somewhat larger amount of uranium highly enriched in U-235, and the completion of high explosive (HE) weapon research for the design of an implosion system and fabrication of a device. It would be capable of being delivered to a target only by a transport aircraft or some form of surface transport; or, in the extreme, it would be so large that it would be suitable only for a demonstration test.

(b) *an indigenous development program* to include contracted assistance from outside sources. Neither national, or subnational, theft nor purchase of nuclear weapons is considered. Also not considered are the use of nuclear material owned by other countries or the "crash" construction of nuclear reactors designed only for the production of plutonium.

(c) *a production capability* that would not necessarily violate the letter of the safeguard provisions of the IAEA or NPT. NPT safeguards prohibit the manufacture of nuclear explosives. IAEA safeguards that apply to non-NPT parties do not necessarily preclude the development of peaceful nuclear explosives. The Director General of the IAEA has stated, however, that the safeguards involve an obligation that the nuclear materials should not be used for the development, manufacture or testing of nuclear explosives of any kind. Neither set of safeguards addresses high explosive research or nuclear explosive design work. A treaty or safeguard violation would not occur until fissionable material was diverted to prohibited nuclear explosive use. A violation would be *confirmed* if an unauthorized device were to be exploded or if the possession of illegal nuclear explosives were officially acknowledged.

4. Based on the foregoing criteria, our evidence on the plans and activities of the various countries, and our assessment of their technical capabilities, we have estimated an *earliest technically feasible date* that a country could have an unweaponized nuclear device in hand. No allowances are made for possible delays in decisionmaking that might stem from poor technical planning and execution, or for delays generated by external obstacles and pressures. It is an earliest date based on technical feasibility, *not* a date considered probable.

B. Key Technical Considerations

5. Our estimates are based for the most part on the availability of plutonium that is produced by power or research reactors and the assumption that it is usable in a nuclear explosive.[3] In the case of

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[2] *Separated plutonium* is plutonium (either weapon-grade or reactor-grade) that has been removed by chemical reprocessing from irradiated reactor fuel. *Reactor-grade plutonium* is "dirty" plutonium (i.e., high Pu-240 content) produced in a power reactor in normal operation. *Weapon-grade plutonium* is "clean" plutonium (i.e., low Pu-240 content) produced in a power reactor or research reactor where the irradiation time of the fuel is limited.

[3] This relatively crude assessment stands in contrast to the US nuclear weapons program where overriding importance attaches to many other considerations such as very elaborate requirements for nuclear safety and the special design objective of high efficiencies produced by compact devices deliverable by advanced weapon systems.

the South Africans, however, our estimate assumes as the fissionable material enriched uranium from their uranium enrichment pilot plant now reportedly in operation.

6. There is little reasonable doubt that many countries could design and manufacture a few nuclear devices using either weapon-grade plutonium or reactor-grade plutonium.[4] The designers probably would have high confidence, without testing, that their devices would yield at least a kiloton or two, though they might be less certain about actual yields which indeed would be highly variable, especially if reactor-grade plutonium were involved. We do not know, of course, whether that confidence in the potential performance of an untested device could be imparted successfully to a country's military and political leadership.

7. If size is not a constraint, development of a fuzing and firing system suitable for a nuclear device entails fairly standard technologies and therefore does not constitute a significant barrier. Many of the components needed for such a system could be purchased in international markets, and the necessary development and fabrication work could be performed secretly at a standard electronics installation.

C. Uncertainties and Principal Determinants

8. There are uncertainties of an essentially technical nature involved in estimating the earliest technically feasible date for the fabrication of a nuclear device. They are:

- the time needed to construct a fuel reprocessing facility (such a facility is needed to remove the plutonium from the irradiated fuel elements);
- the wide range of times that might be needed to design a suitable implosion system and conduct its testing;
- alternative possibilities for fissionable material production such as using the kind of plutonium produced by power reactors operating normally or reactors operated in a manner that would result in the production of weapon-grade plutonium; and
- the degree of confidence in the potential performance of a device that the designers feel must be achieved in order to meet whatever criteria have been imposed by the national leadership.

9. And there are much greater uncertainties about potential proliferation that are not technical. To a greater or lesser degree, economic costs must be weighed by decision-makers. But, as we note in SNIE 4-1-74, the principal determinant of the extent of nuclear weapons proliferation in coming years will be *political* considerations. These will include the policies of the superpowers with regard to proliferation, the policies of suppliers of nuclear materials and technology, and regional ambitions and tensions.

10. Recently major suppliers of nuclear materials and technology tentatively agreed on a series of guidelines[5] intended to reduce the possibility that their exports might be applied to nuclear weapon programs. In addition, all major suppliers which are parties to the NPT, undertake not to assist any non-nuclear-weapons state develop nuclear explosives for any purpose, and not to transfer any nuclear material unless it is subject to IAEA safeguards. France has indicated publicly that it would act as though it were a party to the NPT in regard to these obligations.

11. A nonnuclear-weapons state that is an NPT party accepts IAEA safeguards covering the full nuclear fuel cycle. A non-NPT state accepts IAEA safeguards on materials received from suppliers that are NPT parties. These safeguards provide for periodic inspection of facilities and accounting of nuclear materials by IAEA inspectors. There are only a few countries, including Egypt, Israel, India, South Africa, and Spain, which have certain nuclear facilities that are not subject to IAEA inspections. In some of these cases, however, facilities are subject to bilateral safeguards.

12. Although there is no system of formal sanctions against unauthorized use or diversion of nuclear materials, exposure of such an act through the IAEA inspection system would almost certainly risk

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[4] See footnote 2, page 4.

[5] The US, USSR, UK, Canada, France, West Germany, and Japan are the countries involved in developing these guidelines.

loss or curtailment of foreign nuclear assistance. A country undertaking, for example, an ambitious nuclear power program predicated on outside assistance might well regard this risk as unacceptable. A country whose primary objective is fabrication of a nuclear explosive and whose acceptance of safeguards arose from a desire to facilitate acquisition of nuclear materials and technology would presumably be willing to take its chances. It is unlikely that diversion of significant amounts (kilogram quantities) of nuclear materials in violation of safeguards would remain long undetected; thus, in the perception of a potential proliferator, there might be little meaningful choice between clandestine diversion and outright abrogation of safeguards.

D. National Objectives in Developing a Nuclear Device

13. The countries considered in this Memorandum might have one or more objectives for trying to develop a nuclear device despite adverse world opinion. They might wish to have a status symbol which would permit them to achieve recognition as an advanced, and potentially powerful, state. They might wish to have a deterrent to discourage or at least raise the potential cost of the initiation of either conventional or nuclear hostilities by an adversary. A country might want to be able to employ a direct or implied threat to use a nuclear device in order to demand and obtain concessions from an adversary without a similar capacity. It might wish to use the device in a military conflict with a nation that had no ability to retaliate in kind. Finally, a peaceful nuclear explosive program might be the sole objective.

14. Many of the possible objectives of a would-be nuclear proliferator might be achieved without the actual testing of a nuclear explosive or officially acknowledging that it possesses such a capability. A case in point is Israel. It "enjoys" many of the advantages of such possession without having to risk the possible consequences of an official acknowledgement or an actual test of a device or weapon. Israel is, however, remarkable for its technical sophistication. Countries less endowed with skilled personnel may feel that testing is necessary, both to prove design performance and to attract world attention.

II. EARLIEST DATES OF THE TECHNICAL FEASIBILITY OF POSSESSION OF A NUCLEAR DEVICE

15. Estimates of the earliest technically feasible dates, based solely on technical requirements, when potential nuclear proliferators could have their first nuclear explosive follow. (See Table 1 for the listing of these dates by country.)

A. The Republic of China (ROC)

16. There is convincing evidence that the ROC has a specific program to develop nuclear devices. There is, however, no evidence on which to base a judgment about whether or when this work might be converted into a nuclear *weapons* program. We believe, nonetheless, that the ROC's fear of the power of the Peoples Republic of China and of isolation from the other nations of the free world and its concern over the extent of US support establish a strong incentive for development of a nuclear weapons capability.

17. Shortly after the detonation of the first nuclear device in China in October 1964, Chiang Kai-shek ordered the establishment of a nuclear weapon

TABLE 1

EARLIEST TECHNICALLY FEASIBLE DATE FOR A NUCLEAR DEVICE*

Japan	Within 1-2 years of a decision
West Germany, Italy, Canada, Sweden, Spain	Within 1-2 years of a decision
Republic of China	1978
Pakistan	1978
South Africa	1976-1978
Argentina	1978
Republic of Korea	1979
Brazil	1980
Yugoslavia	1980
Iran	1982
Egypt, Iraq, Saudi Arabia, Libya	Unlikely before 1983
North Korea, Cuba, North Vietnam	Not within next 10 years
Eastern European nations	Not in the foreseeable future

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*A *nuclear device* based on the possession of about 10 kilograms or more of separated plutonium or a somewhat larger amount of highly enriched U-235, and the completion of HE weapon research for a successful implosion system and fabrication of a device.

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Nuclear Activities of Selected Countries

(Revised and Updated)

	DOMESTIC URANIUM ORE	URANIUM ENRICHMENT *	URANIUM ENRICHMENT **	URANIUM ENRICHMENT ***	NATURAL URANIUM FUELED REACTORS		ENRICHED URANIUM FUELED REACTORS AND FAST BREEDERS		CUMULATIVE PU PRODUCTION BY 1975 (KG)****	CUMULATIVE PU PRODUCTION BY 1980 (KG)*****	FUEL REPROCESSING CAPABILITIES (CURRENT)	HEAVY WATER PRODUCTION	NON-PROLIFERATION TREATY	LIMITED TEST BAN TREATY
ARGENTINA	●				1	1			160	1,160	△	□		S
AUSTRALIA	●	□											R	R
AUSTRIA								1		980			R	R
BELGIUM							3			2,350			R	R
BRAZIL	•	□						1		200		□		R
BULGARIA	●						1	3	160	2,750			R	R
CANADA	●				8	5			4,690	17,700	□	○	R	R
CHINA, REP. of				□	1			3	16	1,800	□		R	R
CZECHOSLOVAKIA	●				1			4	330	1,600			R	R
DENMARK (GREENLAND)	•												R	R
EGYPT	•												S	R
FINLAND								4		1,350			R	R
GERMANY, EAST	●	□					2	2	250	3,200			R	R
GERMANY, WEST	•	△		□	2		9	17	4,360	20,400	△	△	R	R
GREECE	•												R	R
HUNGARY	●							1					R	R
INDIA	•	□			2	3	2		1,230	3,300	○	○		R
IRAN								1					R	R
ISRAEL	•	□		□	1				85	140	□			R
ITALY	•	□	□		1		2	3	2,418	5,600	△		R	R
JAPAN		□	□	□	1	1	8	21	4,400	24,600	△		S	R
LIBYA													R	R
MEXICO	•												R	R
NETHERLANDS		△		□			2		270	1,050			R	R
PAKISTAN	•				1				210	550				S
PORTUGAL	•													S
ROMANIA	•												R	R
SOUTH AFRICA	●			△										
SOUTH KOREA								2		760			R	R
SPAIN	●				1		2	7	880	5,950	△			R
SWEDEN	●		□	□	1		2	8	1,440	8,850			R	R
SWITZERLAND							3	3	1,600	4,600			S	R
YUGOSLAVIA	•							1		350	△		R	R

*Gas Centrifuge

**Gaseous Diffusion

***Other

● Major

● Significant

• Minor

[8] In operation as of August 1975

[8] Under construction or planned for operation by 1980

○ Operating plant

△ Pilot plant

□ Research

R Ratified

S Signed but not ratified

****All reactors, including research reactors, capable of producing significant quantities of plutonium.

*****Most of this plutonium will be high burn-up material and most will still be contained in the spent fuel. Figures are estimates based on proposed operating procedures. Actual amounts will vary depending on how reactors are operated.

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research institute, which he initially placed under military control. Although it was announced in 1968 that the institute was being transferred to civilian authorities, there is evidence that the military still plays a major role in its operation. There have been several recent reports that the institute is now carrying out research and development on high explosives and design work on nuclear explosives and that it is acquiring certain materials suitable for the fabrication of nuclear devices.

18. A 40 megawatt, natural uranium reactor has already operated long enough to have produced irradiated fuel elements containing enough plutonium for one or two nuclear devices. A pilot chemical separation plant is planned; it will have the capacity to separate enough plutonium each year for at least one device. The ROC attempted earlier this year to obtain from France the design of a separation plant, but the French Government aborted the transaction. There is recent evidence that the ROC now intends to design and build the facility on its own with some foreign technical assistance and using components purchased abroad. We judge that Taiwan has the technical competence to succeed in this project within two or three years. It will then be in a position to divert separated plutonium to fabrication of a nulcear device. In so doing, however, it would violate its obligations under the NPT as well as the resultant IAEA safeguards that apply to all of its nuclear materials. The potential availability of this plutonium, coupled with the ongoing high explosive and weapon research and development, lead us to the judgment that the ROC could have a nuclear device in hand *as early as 1978*. It is unlikely to attempt to actually fabricate a device, however, before it judges the political and strategic situation to be desperate enough to justify open acknowledgement of a nuclear explosive capability.

B. Pakistan

19. The uneasiness in Pakistan which developed after the Indian nuclear test of 1974 was subsequently increased by India's continuing naval development program, its absorption of Sikkim, and its agreement with Kashmiri nationalist leader Sheikh Abdullah in February 1975 that further consolidated its hold over most of disputed Kashmir. Although India and Pakistan made progress in the past year in resolving some of their differences on trade and communications, key differences remain, and the Pakistanis continue to hold that India seeks a weak, unstable, and even a dismembered Pakistan.

20. Shortly after the Indian nuclear test, Prime Minister Bhutto reportedly stated [redacted] (b)(1) [redacted] (b)(1) that he had completed a plan which would insure that Pakistan would produce a nuclear device in four years. Bhutto stated publicly in late 1974 that Pakistan would explode a nuclear device if denied the help it sought in strengthening its conventional military capabilities. The US decision in February 1975 to end its embargo on sales of conventional arms to Pakistan and India may have reduced Pakistan's motivation to develop nuclear weapons, but we believe that it did not remove it. On balance, we conclude that the Pakistanis still intend to try to acquire a nuclear capability.

21. Since 1972, the Pakistanis have been operating a natural uranium power reactor. We estimate that there could be as much as 200 kilograms of plutonium in irradiated fuel elements being stored in the site's cooling ponds. Pakistan plans to construct a small chemical reprocessing facility with French assistance, but negotiations have been deadlocked over the issue of safeguards and no contract has yet been signed. The French are insisting on stringent conditions which include IAEA safeguards and a prohibition against retransfer of materials and against replication of the technology. Strict adherence to these conditions would severely circumscribe the facility's value for a nuclear weapons program. We believe that the facility could be completed two or three years after construction begins. Assuming an early start, as well as completion of HE and weapons research and development (R&D) concurrent with construction of the reprocessing plant during this time period, the Pakistanis could develop a device *as early as 1978*.

C. South Africa

22. There is no indication that South Africa currently is pursuing a nuclear weapons program. The only likely military threat to South Africa would come from its African neighbors. Its military capability is so much greater than theirs that it has

no military need for nuclear weapons in the foreseeable future. Its political and psychological isolation could, however, affect its perception of such a threat and it might then feel the need to enhance its already significant deterrent capability with nuclear weapons.

23. South Africa is not a party to the NPT and, although it requires IAEA safeguards to apply to all nuclear materials it exports, some of its own nuclear facilities are not subject to safeguards. South Africa enjoys, therefore, a measure of flexibility not available to NPT states or to states dependent on the major suppliers for nuclear materials and technology. On the other hand, a South African official has indicated that his government will consider ratification of the NPT, if it is demonstrated that safeguards can be applied in a manner that both satisfies IAEA requirements and preserves the secrecy of South Africa's enrichment process.

24. Although South Africa will have no power reactors until the 1980s, a plant for the separation of uranium isotopes is now in operation. The South Africans have announced that the plant produces only low-enriched material. But it may be able to produce highly enriched material now; if not, it probably could be adapted either by use of a different operational mode (called "batch" operation) or through plant modification which probably would take a year or two. If the design of the plant enables it to produce highly-enriched material now, enough of this material could be available for a nuclear device as early as 1976. Although we have no evidence of high explosive and weapon research and development underway in South Africa, such activities could be taking place and, indeed, could have been completed already without our knowledge. We conclude that South Africa could develop a nuclear device, using U-235, *sometime in the 1976-1978 period.*

D. The Republic of Korea (ROK)

25. President Pak Chong-hui's decision to give high priority to a nuclear explosives program reportedly remains firm despite increasingly evident problems associated with its cost and complexity and the risk that pursuit of such a program will have adverse political effects in the region and seriously complicate ROK-US relations. Present efforts largely are confined to the planning stages and much of what has been done so far is in direct support of the government's ambitious power program. A US-supplied power reactor which uses slightly enriched uranium probably will be operational in 1977, and by 1978 will have produced irradiated fuel suitable for reprocessing. The ROK government is currently negotiating with the French for the construction of a small reprocessing plant. In the face of strong US pressures to prevent such an arrangement, the ROK has taken an equally strong position that it has the right to have such a plant, on the basis that it is intended only for training purposes and therefore does not represent a potential for the development of nuclear explosives.

26. If the ROK and France conclude an agreement and the ROK chooses to defy US prohibitions against indigenous reprocessing of fuel from reactors it has supplied, the ROK might be able to begin producing plutonium in 1978. On that basis, and assuming that the high explosive and weapons research and development are completed by that time, the ROK conceivably could have a nuclear device *as early as 1979.* Even then, the ROK would have to violate or abrogate safeguards and NPT obligations in pursuing an explosives program.

E. Other Countries

27. We have detected no recent changes in the basic attitude of either *Argentina* or *Brazil* toward a nuclear weapons program. Recent publicity given to the potential for such a program in each country—sparked by the Brazil-West German accord—has stirred up a good deal of nationalistic rhetoric. Government spokesmen in Brasilia and Buenos Aires still officially deny any intentions to go forward with a nuclear weapons program. Should either become convinced that the other was embarked on such a program, it undoubtedly would follow suit.

28. *Argentina.* Irradiated fuel in a natural uranium power reactor, in operation in Argentina since 1974, contains enough plutonium for several nuclear devices. A small chemical separation plant is now under construction and we estimate that it probably will be able to separate enough plutonium each year for a few nuclear devices. It

could be operational in 1977. Assuming that high explosive and weapon research and development are completed by then, a nuclear device could be available *as early as 1978*. Argentina's current economic crisis, however, has slowed down work on some of its nuclear projects. Financial and other problems besetting its nuclear program will probably delay completion of the chemical separation plant.

29. *Brazil*. There will not be a nuclear power reactor in operation in Brazil before 1978. The package deal that has been negotiated with West Germany includes the acquisition by Brazil of a chemical separation plant, in addition to several reactors and a facility for uranium isotope separation. It is highly unlikely that the uranium isotope separation facility will be operational before 1980, but the chemical separation facility could be operating by the time that irradiated fuel is being discharged by the power reactor supplied by the US. Assuming the successful completion of HE and weapon R&D, as well as unrestricted use of the German-supplied reprocessing facility, Brazil could have a device *as early as 1980*.

30. *Iran*. The very ambitious nuclear power program of Iran includes the planned purchase of reactors from the US, France, and West Germany, and possible collaboration in nuclear development with South Africa. Preparation of the site for the first reactors is now underway. It is not likely, however, that any of these reactors will be in operation before 1980-1981. Iran is also seeking a chemical reprocessing facility; one could be constructed by the time the first power reactor is complete. (The US has not yet succeeded in its efforts to convince Iran that such a chemical reprocessing facility should be owned and operated on a multinational basis.) Iran could also conduct the necessary HE and weapons R&D during this period and thus conceivably could have a nuclear device *as early as 1982*.

31. *Japan, West Germany, Italy, Canada, Sweden, and Spain*. These industrially advanced countries all have operating power reactors. In most cases they possess significant quantities of plutonium already separated from irradiated reactor fuel. In the case of Spain, there is a report that the Nuclear Energy Board has studied the feasibility of producing nuclear weapons using such plutonium from its power reactors. However, there is no indication that HE and weapon R&D have actually been undertaken either in Spain or in the other countries. All of these countries have the capability to conduct such HE and weapon R&D, however, and any of them could have a nuclear device *within one or two years of a decision* to develop one.

32. *The Arab States. Egypt, Iraq,* and *Saudi Arabia* have expressed an interest in developing nuclear power programs. The development of nuclear devices depends on the time that is required to negotiate contracts for the acquisition of nuclear power reactors and chemical separation facilities and to construct and operate them. Given the time needed to satisfy all of these requirements it is *unlikely* that any of these states could have a nuclear device *in less than eight years*—that is, before about 1983. Although *Libya* has ratified the NPT, acquisition of nuclear weapons became a stated objective of Qadhafi in 1974 (indeed, Qadhafi reportedly has tried to purchase nuclear devices outright). But the acquisition of nuclear reactors is still in the negotiating stage and reportedly the negotiations are aimed at obtaining one from the USSR for operation about 1982. Considering the time needed for training personnel and for reactor construction and operation, it is *unlikely* that Libya could have a nuclear device *before 1983*.

33. *North Korea, Cuba, and North Vietnam*. These countries have varying degrees of incentive to acquire a nuclear weapon. North Korea and Cuba have indicated an interest in obtaining nuclear reactors, and they have attempted to obtain assistance to this end from the West as well as the Soviet Union. We do *not* believe, however, that sufficient aid will be supplied to permit the development of a nuclear device by any of these countries *within the next ten years*.

34. *Yugoslavia*. Yugoslavia has a program for developing a capability to construct nuclear power reactors and to fuel them with domestic uranium. A very small chemical reprocessing facility also has been constructed. It has reprocessed some of the irradiated fuel from a research reactor supplied by the Soviets in 1966. Its first nuclear power re-

actor was purchased from the US and is scheduled to be operating about the beginning of 1979. There is no evidence that Yugoslavia intends to construct reprocessing facilities large enough to handle the irradiated fuel from this reactor. If it should decide to do so concurrently with the construction of the reactor, however, and if it completes necessary HE and weapon R&D, it could have a nuclear device in being *as early as 1980.*

35. *Other Eastern European Nations.* Although several of the Eastern European nations have nuclear power programs, it *is not* considered likely that any of them will be able to develop a nuclear device *in the foreseeable future.* The Soviet Union probably will not permit these nations to build and operate fuel reprocessing facilities of significant size or to have uncontrolled access to sufficient plutonium for use in fabricating nuclear explosives.

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250,000-b/d capacity—appears to have been burned and possibly ruptured. Major damage to the cooling towers has shut down one of two steam plants needed to run the processing units, and significant pipeline damage also occurred. The refinery is the largest supplier of gasoline in Iran. If one of the distillation towers is critically damaged, replacement could take six months, creating serious fuel shortages in Tehran and the heavily populated northern areas. Iran's distribution system is not capable of handling the volume of imports needed to offset a large loss in domestic production. [redacted] (b)(3)

UK Gas Reserves Estimate Revised Downward

London is unlikely to change its policy toward importing gas from Norway's Sleipner field despite a downward revision in domestic gas reserves. This year's Department of Energy review estimates that gas reserves are 50 billion cubic meters less than was estimated last year. The new, lower gas estimate is in sharp contrast to last year's, which was used as justification for London's veto of the proposal by British Gas to purchase Sleipner gas. British Energy officials, already concerned about the sharp drop in oil exploration occurring because of low oil prices, appear unwilling to take any action that would reduce North Sea gas development over the next few years. [redacted] (b)(3)

Setback for Yugoslav Nuclear Program

The Chernobyl' accident is strengthening antinuclear sentiment in Yugoslavia and casts further doubt on plans to build four nuclear plants by the end of the century. Last week the Republic of Croatia, questioning the need for nuclear power and citing Chernobyl', removed any commitment to nuclear energy from its development plan for 1986-90. This at least postpones plans for a $2.5 billion nuclear plant near Zagreb for which a US firm and the Soviets are competing. Zagreb health authorities have recently demanded a ban on all new nuclear construction. The Croatian decision reflects the growing debate over Yugoslavia's nuclear program. Antinuclear proponents, including some prominent party and republic leaders, argue that the program is economically infeasible and technically unsafe and that existing energy sources should be developed first. About 70,000 Serbian students have signed a petition against nuclear power, and the Republic of Slovenia earlier reduced its commitment to the Croatian plant. The Soviet nuclear accident could cause strains in bilateral ties if Belgrade asks Moscow for compensation [redacted] (b)(3)

India Unable To Meet Coal Production Target

A recent coal strike typifies the problems New Delhi faces in meeting its economic growth target. In a recent trend of joint union action, 700,000 miners responded to a call by Communist and democratic unions for a one-day strike over industry hiring practices. Labor unrest, persistent power shortages, underutilization of machinery and equipment, and transportation bottlenecks make it unlikely that India will meet its coal production goal. Annual coal production—currently some 150 million tons—must increase by 10 percent to sustain the current five-year plan's projected yearly growth rate of 5 percent for the economy. About 65 percent of the country's electricity is generated by coal-fired thermal power, and electrical shortages are a major obstacle to increasing productivity and output of exportable goods. [redacted] (b)(3)

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European Review [redacted] (b)(3)

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Articles

Europe, West and East: Chernobyl Disaster Will Slow Some Nuclear Programs [redacted] (b)(3)

Not unexpectedly, the explosion of the Soviet Union's nuclear power facility at Chernobyl is generating contrasting official and public reactions in the two Europes. In the West, the disaster has revitalized antinuclear movements and forced most governments to reexamine the future of their nuclear programs. Leaders there will have to contend with the general public's heightened alarm over safety standards, which in some countries will mean delaying construction of planned new plants. Nuclear safety also is already becoming a heated issue in election campaigns, and environmentalist parties seem likely to strengthen their support. In the East, the accident also has aroused popular anxieties, but—apart from Yugoslavia—environmentalist groups are small and have virtually no influence with the ruling Communist parties, and the regimes have long-term commitments to nuclear power as a major means of coping with their chronic energy shortages. [redacted]

Western Europe

In Scandinavia, where evidence of the accident materialized days before the Soviet acknowledgment, reactions have been of mixed intensity. Stockholm and Copenhagen both described Moscow's withholding of information as irresponsible and dangerous. Sweden reaffirmed previous plans to gradually phase out its 12 nuclear power plants by the year 2010 and promised to reassess its entire energy program in response to strong public reaction to the Chernobyl disaster. Even before the accident, a new law had been proposed to ban further construction of nuclear power plants as the government sought to demonstrate its commitment to a 1980 nuclear referendum decision. In Denmark, the government has demanded that Sweden shut down its Barseback plant on the grounds that the safety of thousands of Danes living just across the border from the facility is in jeopardy. Finland, which has been considering the purchase of a third nuclear plant from the Soviets, may now scuttle the project. [redacted] (b)(3)

The US Embassy in The Hague reported that continuing controversy over nuclear power in the Netherlands has been heightened by the Chernobyl incident. A long-awaited parliamentary debate on sites for two new Dutch plants—scheduled for mid-May—has been delayed indefinitely pending a thorough analysis of the Soviet accident. Labor Party leader den Uyl, anxious to capitalize on the heightened antinuclear sentiment in the 21 May national elections, went further and pledged to cancel all Dutch plans for expanding the nuclear power program. At the same time, Prime Minister Lubbers confided to the US Ambassador that the Chernobyl accident had also seriously eroded support for the nuclear program among the conservative Christian (b)(3) Democrats, making it unlikely that any new government will tackle the nuclear question for many months. [redacted] (b)(3)

Repercussions are also being felt in the United Kingdom, where the Thatcher government had an ambitious development program and was hoping to obtain parliamentary approval for four new nuclear waste disposal sites and for a new $2 billion pressurized water reactor at Sizewell. According to press reports, public pressure since the Chernobyl accident has already forced London to drop plans for the new sites while it undertakes a major review of the nation's nuclear waste disposal strategy. Further actions on the Sizewell facility or any other nuclear programs in Britain also are likely to be stalled. Leaders of both the Labor Party and SDP/Liberal

Alliance must now respond to growing grassroots opposition to nuclear power projects, and the Tories also must work out emerging new disputes—most blatantly the one between Energy Secretary Walker and Minister for the Environment Waldegrave over the need for nuclear power development versus issues of environmental safety [redacted] (b)(3)

In West Germany, a recent poll found that fully one-third of the respondents had changed their views on the use of nuclear energy since the accident. That issue also has entered the domestic political scene, with the Social Democrats pledging to make nuclear energy a focus of their campaign in the Lower Saxony state election in June. In contrast to the Christian Democrats' staunch support for nuclear industry, Gerhard Schroeder, the SPD's leading candidate there, claims he will treat the poll as a popular referendum on the industry's future in the state. Most observers also expect the antinuclear Greens to reap electoral benefits from the accident in a series of local and state elections this year and possibly in the national election next January. [redacted]

In Italy, the Chernobyl accident is invigorating an aggressive and well-organized antinuclear lobby in its attempts to convince Rome to abandon plans to construct three new nuclear power plants. The government has ordered that work on two projects in Lombardy and Puglia be postponed indefinitely. In addition, municipal authorities at Trino Vercellese—site of the next scheduled nuclear power station—have asked the national electricity agency, ENEL, to postpone site preparations until new safety standards can be established. For most Italians, the Soviet disaster amplifies a longstanding wariness of nuclear energy. Nearly 80,000 people joined in an antinuclear demonstration on 10 May, and a recent poll conducted by a leading newspaper found that 79 percent of those questioned oppose construction of new plants. Although most parties in Italy's coalition government have voiced support for a nuclear energy program, Prime Minister Craxi's Socialist Party has asked for a national referendum on the issue, and the large Communist Party also has demanded a parliamentary debate. [redacted]

Political fallout in France from the Chernobyl accident thus far has been minimal, and we doubt that the incident will have a significant impact on the nation's nuclear program. France depends more heavily than any other West European country on nuclear power for electricity—about 65 percent of its power is currently nuclear generated—and the public generally has been supportive of the nuclear industry. Moreover, the French have great trust in their technology and are confident that French safety standards far exceed those of the Soviet Union. Paris is also loath to publicize the dangers of nuclear energy because it is relying increasingly on nuclear technology exports to make its industry more cost effective. [redacted] (b)(3)

Eastern Europe

Although the Chernobyl accident has stirred up widespread anxiety in most of the East Bloc, environmental movements there are small by Western standards and have little if any influence on the ruling Communist parties. Moscow's CEMA allies almost certainly will remain committed to expanded use of nuclear power because they lack adequate reserves of clean-burning fossil fuels. [redacted] (b)(3) (b)(3)

Environmentalist concerns over the danger of nuclear power have never had much influence on the Communist regimes of Eastern Europe. The latter view their small environmental movements suspiciously and subject them to police harassment and media scorn. Nuclear power tends to be regarded as a virtually inexhaustible energy source free of the environmental pollution created by other energy sources and a means to more economic independence. Only Yugoslavia has an influential antinuclear movement with prominent national and local leaders who argue openly that because of the dangers and economic costs of nuclear power other energy sources should be developed first [redacted] (b)(3)

Nonetheless, most official East Bloc commentaries justifying government commitments to nuclear programs in the wake of Chernobyl have struck defensive tones and attempted to reduce popular

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anxiety about the safety of reactors. Initially, they followed the Soviet line by playing down the seriousness of the accident. This tack was abandoned when the Soviets themselves began to release more information on the disaster. Since then, the media—particularly in Hungary, East Germany, and Czechoslovakia—have stressed the benefits of nuclear power and emphasized the safety and advanced technological features of their own reactors. [redacted] (b)(3)

In Yugoslavia, however, the Republic of Croatia has questioned the need for nuclear power and deleted any commitment to nuclear energy from its 1986-90 development plan. The decision postpones at least temporarily earlier plans to build a $2.5 billion nuclear plant near Zagreb. [redacted] (b)(3)

Over the longer term, the Chernobyl disaster almost certainly will encourage East European governments to improve the safety of their nuclear reactors and make them more mindful of the need to locate their plants farther away from heavily populated areas. Such actions would increase the costs of nuclear power and perhaps stimulate arguments for slowing down the pace of construction. While such an outcome seems unlikely given Eastern Europe's lack of alternatives, the probability would increase if popular anxiety over safety mobilizes effective dissidence—and if oil prices remain at their current low levels. [redacted] (b)(3)

[redacted] (b)(3)